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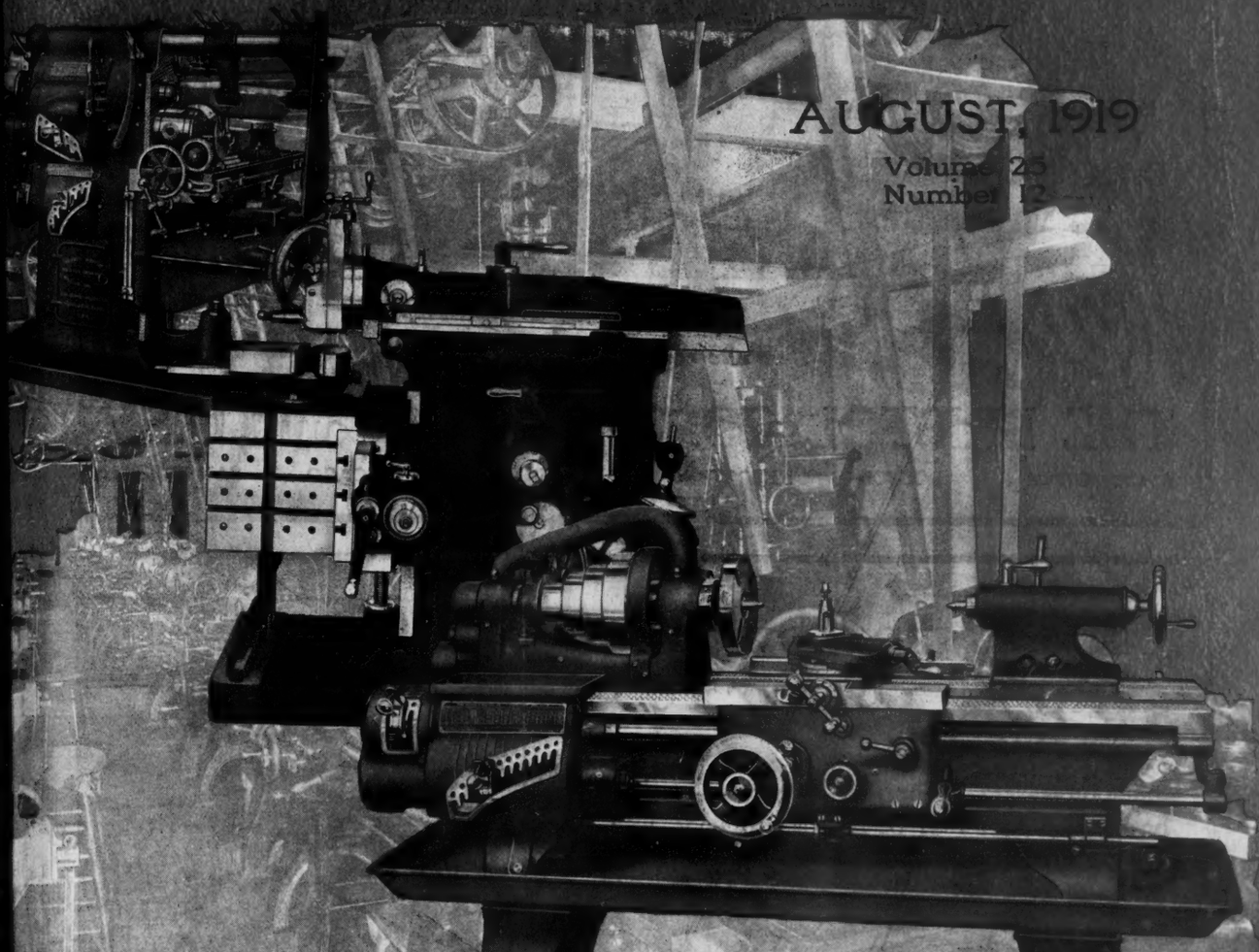

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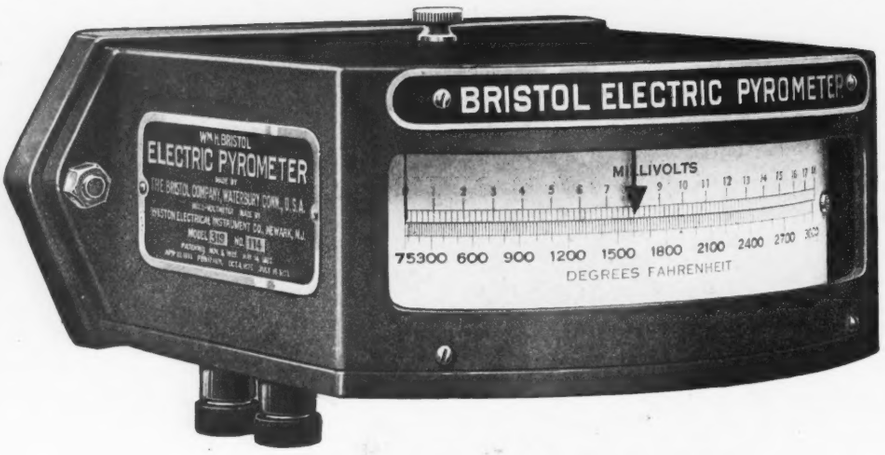


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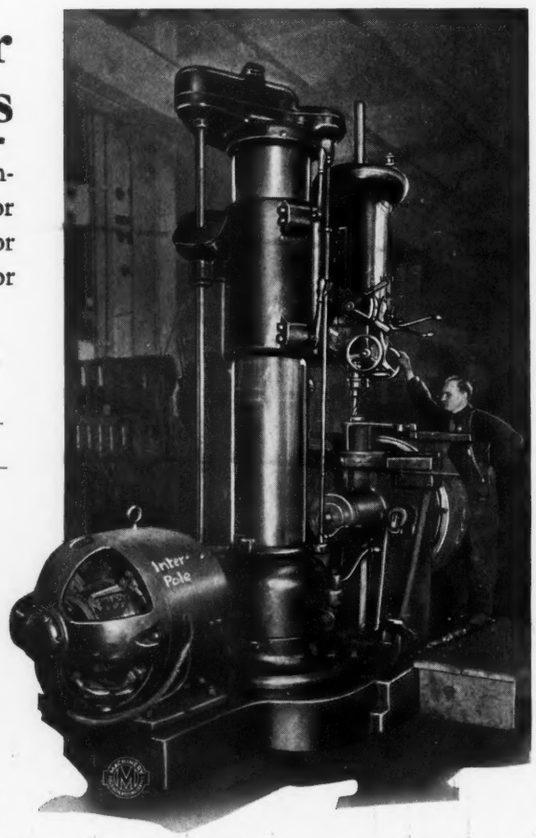


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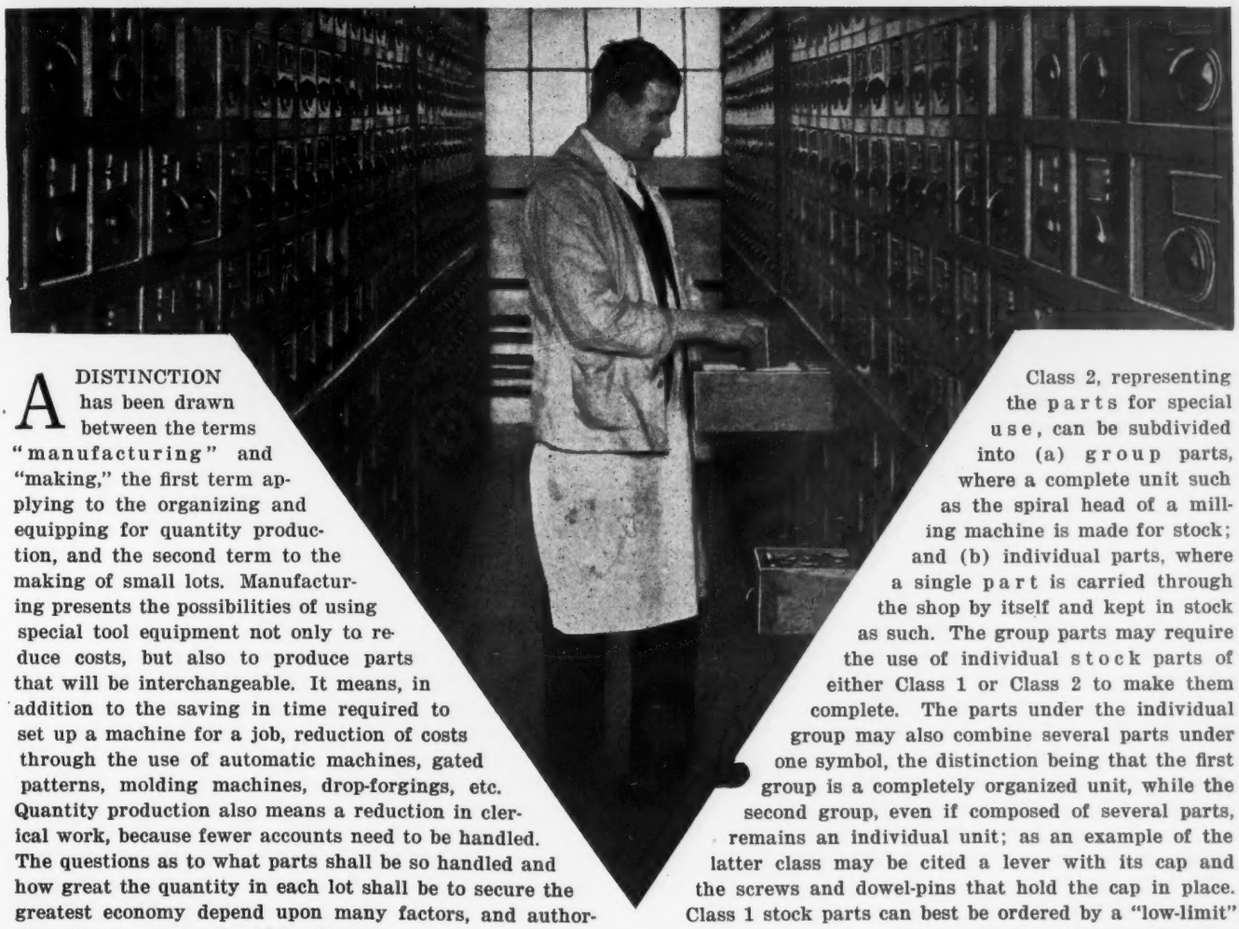
# Stock Parts and Their Routing



**The Classifying, Ordering, Routing and Storing of Stock Parts—A Description of a System that has Proved Successful. By Luther D. Burlingame, Industrial Superintendent, Brown & Sharpe Mfg. Co., Providence, R. I.**

A DISTINCTION has been drawn between the terms "manufacturing" and "making," the first term applying to the organizing and equipping for quantity production, and the second term to the making of small lots. Manufacturing presents the possibilities of using special tool equipment not only to reduce costs, but also to produce parts that will be interchangeable. It means, in addition to the saving in time required to set up a machine for a job, reduction of costs through the use of automatic machines, gated patterns, molding machines, drop-forgings, etc. Quantity production also means a reduction in clerical work, because fewer accounts need to be handled. The questions as to what parts shall be so handled and how great the quantity in each lot shall be to secure the greatest economy depend upon many factors, and authorities have expressed widely divergent views on the subject, even though based on what they considered conclusive evidence. It is not the purpose of this article to enter into a discussion of this phase of the subject, but to assume that manufacturing methods, including quantity production, are in vogue, requiring some system of caring for stock parts and some method of routing them through the shop, and to describe a method of handling them that has been successful.

### Classification and Ordering of Stock Parts

Stock parts can be divided into two classes: First, those for general use, such as screws, studs, nuts, washers, wrenches, etc.; and, second, those for special uses, which are not adapted to a change in design. Class 1 covers many diversified products which in large manufactories amount to thousands of kinds and may necessitate carrying a stock of millions of parts. Full lists of these parts indicating their symbols and sizes should be given to all designers, draftsmen, and department heads throughout the shop. Sample pages from these lists are shown in Fig. 1. From this stock the needs of the shop are met and customers can be supplied with repair parts without delay.

Class 2, representing the parts for special use, can be subdivided into (a) group parts, where a complete unit such as the spiral head of a milling machine is made for stock; and (b) individual parts, where a single part is carried through the shop by itself and kept in stock as such. The group parts may require the use of individual stock parts of either Class 1 or Class 2 to make them complete. The parts under the individual group may also combine several parts under one symbol, the distinction being that the first group is a completely organized unit, while the second group, even if composed of several parts, remains an individual unit; as an example of the latter class may be cited a lever with its cap and the screws and dowel-pins that hold the cap in place. Class 1 stock parts can best be ordered by a "low-limit" system, the size of the order being based on the average number of parts used in a year; the time for the order to be placed depends on the manufacturing time, the order being given when the low limit determined upon has been reached. Class 2 stock parts should be ordered as required for lots of machines in progress and to meet the needs of stock replacements. As they are of a nature that makes them obsolete except for repairs when changes of design are made, the ordering clerks must be in close touch with the drafting and engineering departments so that prospective changes may be taken into consideration when ordering is done.

The carrying in stock of such parts as are used on a number of machines may often reduce the amount of work in progress through the shop at a given time. As an illustration, suppose that five lots, each consisting of fifty machines using a particular stock part, are in progress. Without the stock-part system, there would be five separate lots of fifty each of these pieces in progress, each with its own lot of machines. With this system such pieces can be made in lots of one or two hundred, according to manufacturing conditions, and as they are finished they can be requisitioned for whichever of the five lots of machines is to be completed

first. Thus there are fewer parts in progress and the system proves flexible, allowing for one lot of machines to be held back and another to be pushed ahead as the demands of the trade dictate, without piling up stock or exchanging parts from one lot of machines to another.

Standardizing parts so that the same part is used on as many different machines as possible is also of help to the customer. If he has a large equipment of machines, he often carries some replacement parts for emergencies, and such a system gives the maximum protection against delay from breakdown with the minimum stock of parts on hand, while the manufacturer also benefits because he can carry the minimum stock of parts not only for his own use but also for supplying the customer with repair parts.

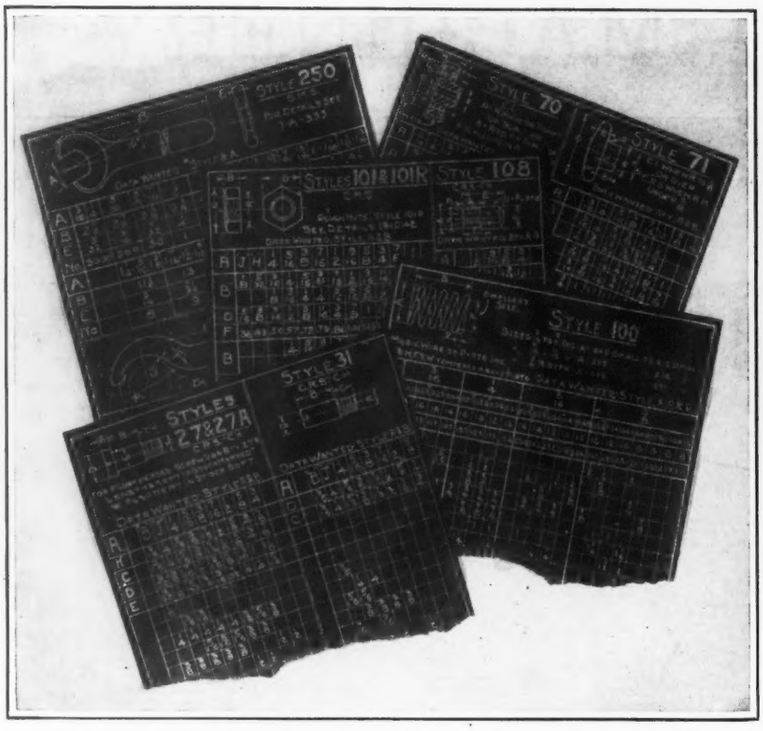



Fig. 1. Sample Lists of Stock Parts, provided for the Use of Designers, Draftsmen, and Department Heads

In addition to this advantage there are many times when in case no changes of design are anticipated, it is economy to combine several lots in one and manufacture for future needs, even if it means carrying some surplus stock for a time. When an order for machines is received, it becomes the duty of the supply department, through its ordering department, to enter the parts required on the cards shown in Fig. 2, and if parts already ordered and in stock are not sufficient to supply the needs, new lots are ordered and so routed as to insure their being completed at the desired time.

### Routing the Parts

When an order is entered for a part to be routed, whether it is a stock part or not, the routing card which is shown in the illustration Fig. 4, is made out by the routing department, which is also connected with the supply department. This routing card gives the order of operations and the date each operation is to be completed; it is placed in an envelope, together with a blueprint of the job, and accompanies the work as it moves to each successive department. The date and order of operations are determined by cooperation with the foremen, a master card being held in the supply department to determine the required sequence of operations on subsequent orders. If for any reason new dates or re-routings are required, notice is sent to the routing department at once on a form shown at the right in Fig. 3. By this system routing becomes automatic in the transfer of the work from one department to another. At the left in the same illustration is shown the method of notifying the routing department of any spoiled work.

Each department is provided with a rack containing forty-eight pockets, four for each month of the year, shown by the upper left-hand section of the case in Fig. 5. In these pockets are placed copies of the routing cards as they are issued. The copies are filed according to the date they are due out of the department. This arrangement enables the foremen to tell at all times the quantity of work ahead and what work must be completed each week. Instead of routing work to the machines it is routed to the departments. Dividing the work into weeks enables the foremen to decide on the men and equipment necessary to do the work required. A board with hooks on which are hung tags showing the dates of deliveries of all machines in progress is located in the supply department to show at a glance the needs and how they are being met.

### Storing

After parts have been completed, they are delivered to the supply department for storage and are obtained on requisition as desired. Even if parts are not actually stored but are used immediately, the requisition is necessary so that the records can be correctly kept. Storage drawers for Class 1 stock parts are shown in the heading illustration. These drawers have adjustable partitions, and, in addition, tin compartment boxes further subdivide the drawers so that when the pieces are small or the number few, space is conserved. The type of racks for storing larger stock parts that is used by the United Shoe Machinery Co. is shown in Fig. 7. These racks are of uniform size and design, and there are sliding ladders between them, affording easy access. One of these ladders is shown in Fig. 6. All of this equipment is made entirely of metal.

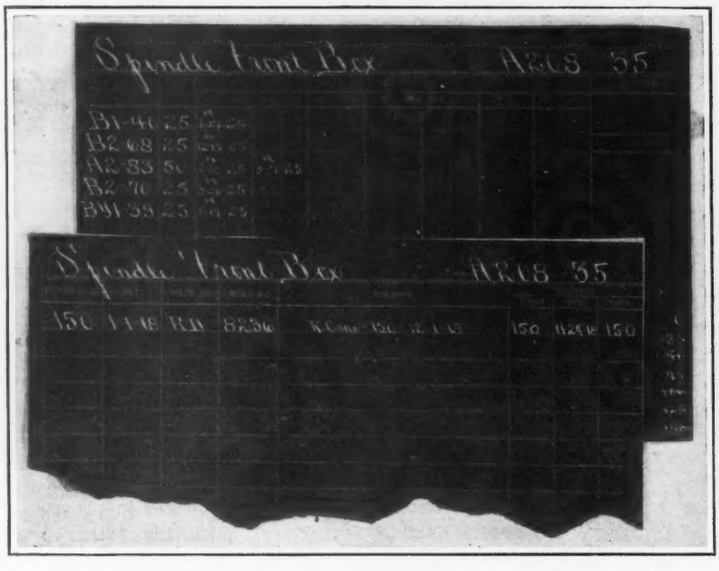



Fig. 2. Opposite Sides of Card upon which Orders and Apportionment of Stock are recorded

Fig. 8 shows a case where the racks are low, and it will be seen that with this design ladders are not needed to reach the parts stored on the shelves. This is such an advantageous arrangement that it is a good plan to build mezzanine floors for this purpose, if possible.

### Repair Parts

Repair parts are often wanted in emergency cases where urgent work is being held up, and anything that will reduce delay and give the customer quick relief, becomes important. Because repairs are generally required many years after the machine is built, and after it has been supplanted by later designs, it becomes especially difficult to give the needed help. To know exactly what to send in answer to a telegram calling for parts of machines built years before would be almost hopeless without an organized system of keeping records of the exact design of every machine built and of every change in design that has been made. In connection with such a system, it is important to store and mark the parts in stock for repairs so that the needed part can be found quickly.

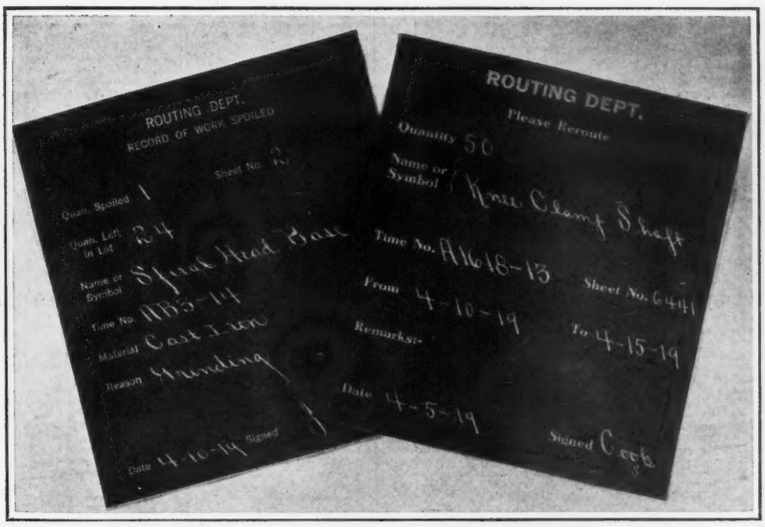



Fig. 3. Notifications of Re-routing and Spoiled Work

### Repair Records

In order to retain such information as will make it possible to send the correct repair parts, it is important to preserve the complete set of blueprints from which each lot of machines has been built, and also to keep a complete record of just what design of stock parts was used for each machine of the lot, it often being the case that a change of design may be made so as to affect only part of a lot, inasmuch as stock parts and stock groups on which changes have been made will not always even up with the lots of machines, part of the lot being made of one design and part of another.

The record of where stock parts of a particular design are used is kept by means of equipment lists filed with the blueprints of each lot of machines. This record shows in detail just what was furnished with each machine, no matter how special it may have been or how long ago it was built, so that whatever is required for replacement at any time can be accurately determined. Serial numbers have been given to all machines built by the Brown & Sharpe Mfg. Co., almost from the beginning of their manufacture in 1860; this custom, combined with the present practice of giving serial numbers to the symbol groups, has proved to be an important aid toward securing a correct record and making it possible to determine just what may be needed for repairs. The serial numbers given to the stock groups are not entered on the equipment lists until the machine is inspected, so that it is certain that no exchanging of parts from one lot of machines to another has made the record incorrect. Serial numbers are not required on individual stock parts in order to preserve their identity, as a new symbol number is given whenever a change is so made that the later design will not interchange with the earlier. A card record, as shown in Fig. 10, is kept to show important changes affecting the design of a machine, and this illustration also shows a blank page from an inspector's report on changes.

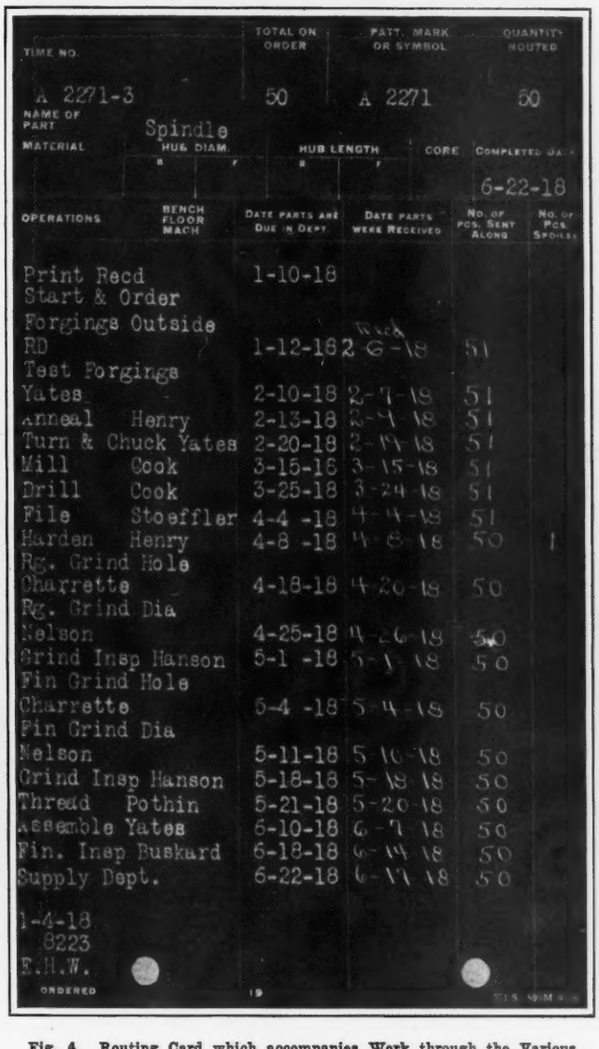



Fig. 4. Routing Card which accompanies Work through the Various Departments

### How to Aid the Customer in Ordering Repair Parts

It is of aid to the customer in ordering repair parts if the manufacturer supplies him with a booklet for each class of machines that the customer has in use, with all the parts numbered and containing a list of the names of the parts. A page from such a booklet is shown in Fig. 9. Thus for the Brown & Sharpe automatic screw machines, several hundred parts are numbered and listed. A request is made on each page that when parts are ordered, the name of the machine and its serial number should be specified. If this is heeded by the customer, the parts can be quickly shipped without doubt as to what is needed, provided they are in stock, and if not in stock, they can be made without delay. A request is made on the cover that the booklet be placed in the hands of the man in the mechanical department who is responsible for writing the requisitions for repair parts, experience having shown that unsatisfactory results often follow when such matters are handled in clerical departments by those having no

Fig. 5. Rack used for filing Routing Cards

Fig. 6. Ladder for Use with Storage Racks

mechanical knowledge of what is wanted. If the repair part desired is not in stock, the blueprint from which the part was actually made is obtained from the files and a photostat copy made to accompany the manufacturing order when it is started through the shop.

The greatest cause for delay in furnishing replacements is the customer's neglect in supplying the necessary information, which is usually easy to secure but is often omitted through carelessness or indifference. When insufficient information is given by the customer, there is sometimes a temptation to take a chance and guess at what he wants, especially when he wishes to get the repair part quickly. This results in many mistakes, and it is better to send for complete information even if it causes some delay. It is often thought that it is of great assistance to send the broken or sample parts to show what is wanted, but unless full information as to the name of the machine and its serial number accompanies the sample it may be difficult to recognize and locate the required part among so many thousands, some of which have not been made for many years.

### Special Conditions Affecting the Keeping of Records

There are many important details and special conditions affecting the keeping of records of stock parts. Sometimes a later design can be used for replacements as well as the earlier design. In such cases it should be arranged to use up the earlier design, the record being so kept, however, that it will be known that the later design can be used. In other cases, where improvements have been made to overcome weakness or other defects of the earlier design, the later design should be used for repairs, even though the earlier design is called for on the records. A special card record of such cases is important for reference. Often some parts which are to be hardened must be sent to the customer soft in order that they may be fitted in place before hardening. In other cases there are deferred operations which, after it is known what the customer wants, can be completed at the factory before shipping.

Sometimes parts of old machines which have not been made as stock parts are preserved. These may have been left over because several more parts were made in a lot

Fig. 7. Storage Rack System used for storing Large Parts

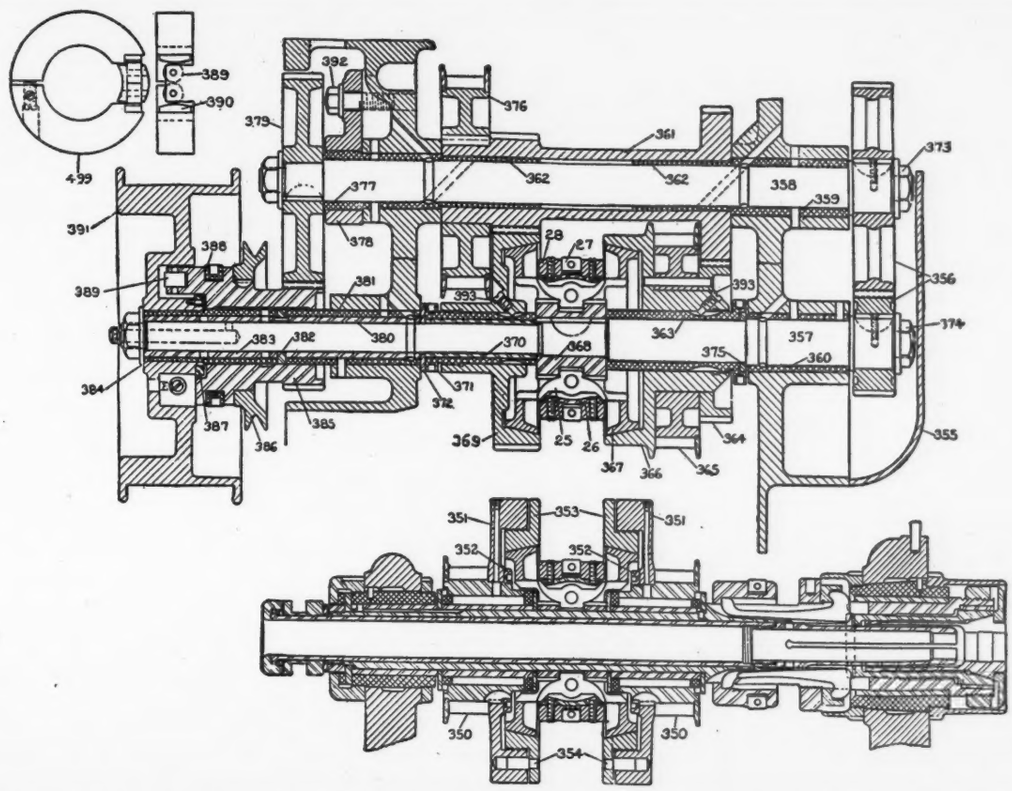
Fig. 8. Low Stock Racks which can be reached from Floor

than the exact number needed, or because a machine was stripped to meet some special requirement of a customer. Such parts are listed as "contingent stock," and often help out in cases where repairs are wanted, this being one of the chief reasons for keeping them on hand. When repair orders come in, these parts must be looked up before starting to make a new part to fill the requirement. To do so without using a prohibitive amount of time in searching necessitates that such parts be classified and card records kept. Another item of importance in this connection is the establishment and maintenance of a consistent and equitable system of charges for repair parts, as the actual cost may vary widely, depending on the conditions of manufacture.

### Issuing Stock Parts for Outside Orders

Mention has already been made of the methods of apportioning and requisitioning stock parts for use on lots of machines in progress. In the case of sales for repairs or the department where the work is to be done, and sends it with the letter back to the correspondence department. If the information given by the customer is not sufficiently clear to be sure of what is wanted, the correspondence department writes to the customer for more explicit data. If sufficient information has been given, however, the order is then sent through the same channel as in the case of urgent orders already referred to, a record being kept on a card, as shown in Fig. 11, to indicate where the correspondence is at any time. This card is printed on both sides and on the upper and lower edges, thus allowing each card to be used four times. If the letter contains orders demanding attention in more than one department, the required number of photostat copies are made and one is sent to each department that is interested.

The repair part clerk in the drafting department also keeps a record on a card, as shown in Fig. 12, of any job going through that department. He keeps the engineering




**Section through Spindle Gear Case and Spindle, No. 2G Automatic Screw Machine.**

**When ordering parts, specify the name of the machine and its serial number.** *Machinery*

**Fig. 9. Page from Book prepared for Customers' Convenience in ordering, giving Numbers for the Different Parts of a Machine**

otherwise, the letter or telegram received from the customer is sent to the credit department, from which it goes to the correspondence department, and in case urgency is indicated, it is given immediate attention, being personally taken to the repair department clerk to secure the symbol of the part, if in stock. If the part is in stock, the correspondence goes to the supply department where the parts are stored. If the part wanted is not in stock, a photostat print is obtained from which it can be made, and a manufacturing number is secured from the timekeeping department, the photostat print being issued with the manufacturing order to the shop This insures the minimum of delay both in furnishing the part directly from stock and in starting the process of manufacture.

When no special urgency is indicated, the order goes from the correspondence department through the regular messenger service to the stock parts clerk, who looks up the records, makes a memorandum of what is wanted, indicating department informed when an unusually large number of repairs are called for in any one case with a view to improving the design or using a more suitable material so as to avoid the need of future repairs. After the parts have been taken from stock or are made to order, they are sent to the inspection department, and from there to the shipping department. While repair orders travel through many hands between the time of the receipt of the order and the final shipment, such orders are given the right of way, and any department holding them up unnecessarily is held accountable. As a stimulus to efficiency in handling orders of this kind, there is a rule that any criticism made by a customer whether justified or not, must be reported to the official who oversees this particular work.

### Conclusion

A natural outgrowth of making and carrying stock parts is to make the work either interchangeable or with such

allowance for fitting as experience shows is required, full information and instructions being given on the drawing so that the work can be produced even without the workman knowing where or how the part is to be used, so that when assembling parts made at different times, in different lots and by different workmen, the minimum of hand fitting will be required. It is not to be expected that any system can be devised that will be so complete as to accomplish the results described without attention to the human element, and without personal supervision and efficiency in each of the departments. No matter how complete, the system is dependent on personal interest and experience for success.

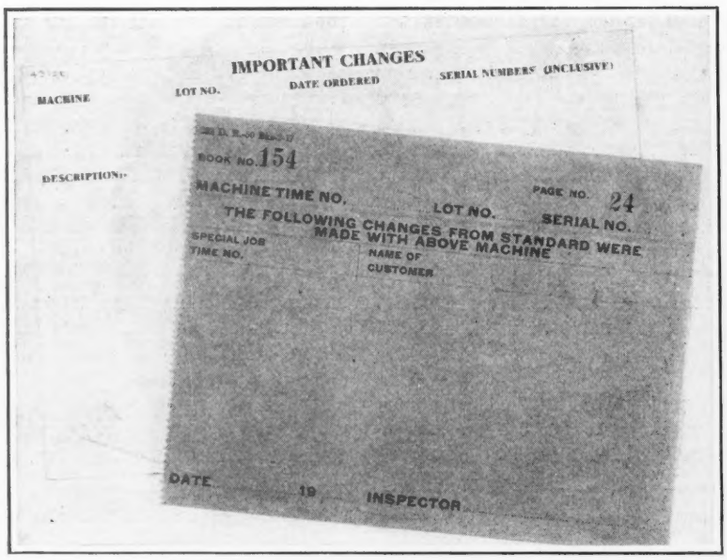



Fig. 10. Card on which Changes in Design are noted, and Inspector's Report on Changes

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## USE OF X-RAY IN METALLURGY

Considerable progress has been made in Great Britain and France in the examination of metals and materials with the X-ray, according to an article in a recent number of the *Iron Age*. The tests made include researches into segregation and blow-holes, influence of aluminum on cast steel, examination of steels containing different percentages of tungsten, and examination of compound metals. One of the earliest applications of the X-ray to metallurgy was in the detection of flaws in steel and other metals. Recent experience shows that with the present apparatus available, it is possible to detect very small flaws in steel 2 inches thick. London experimenters announce, however, that an apparatus has lately been devised with which it is expected to penetrate steel up to 9 inches thick. Cast-steel brackets for gun carriages have been shown by this test to be faulty, and the method of manufacture was changed, resulting in the correction of the defects. The entire internal structure of cartridges and high-explosive shells has been profitably examined without injury to the object and welds have also been found imperfect by the same agency.

One of the most interesting applications of the X-ray is in the analysis of steel. When the percentage of an element of high atomic weight, such as tungsten, is considerable, as in tool steel, the metal is not so permeable to the rays as when the percentage is low. It appears possible to apply radiography to rapid analysis in particular cases, as in the separation of carbon steel from tungsten steel or the differentiation of various tungsten and alloy steels. Another valuable development involves the examination of carbon electrodes for electric furnaces. The suggestion is made that the best use of radiographic examination would properly consist in systematic experiments on electrode manufacture where variations in composition, baking, temperature, etc., would proceed step by step. The causes of premature and frequent breaking in service could thus be detected. The visual examination of aircraft timbers has yielded valuable results. No difficulty has been found in detecting concealed knots, resin pockets and grub holes, or excess or deficiency of glue in glued joints.

Examination of materials without destruction to the object has been the aim for many years. Its partial realization seems nearer as investigations proceed. Not only radiography, but also magnetic analysis are important factors in this evolution. Further work must decide to what degree these new developments in radiography will result in nondestructive testing.

* * *

## CONCRETE FREIGHT CAR

The first plans for the manufacture of reinforced concrete freight cars dates from 1909, when a patent for such a car was granted. Recently, however, a car of the gondola type was built by a western concern and tested under service conditions. The tests of the car, both empty and loaded, demonstrated its practicability for rough service. In the test without a load, it withstood extremely rough handling and switching. Then the car was loaded with fifty-five tons (10 per cent overload) of sand and turned over to a switching crew for service handling, which it also withstood without injury. Some advantages claimed for the concrete car are that it will not need painting, will practically eliminate maintenance charges, and will last much longer than the wooden car. As it is unaffected by its cargo, it is better adapted for hauling slag and ashes than a steel car. Plans are said to be under way for the quantity manufacture of these cars. The first one was built with the cooperation of the United States Railroad Administration, which is an indication that extensive production may not be delayed very long.

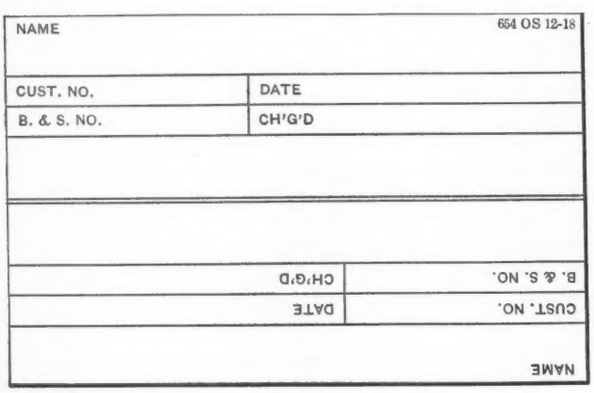



Fig. 11. Card for keeping Record of Correspondence in the Shops

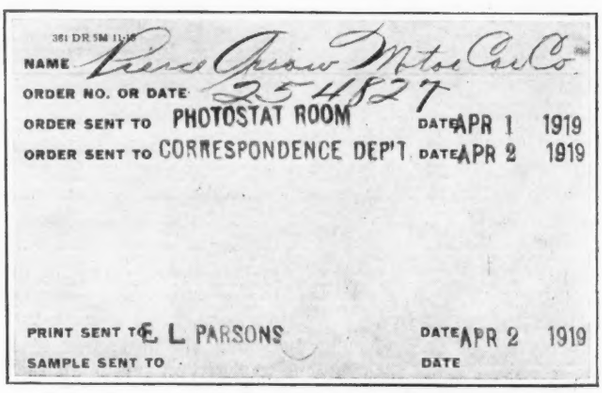



Fig. 12. Record Card kept by Repair Part Clerk in Drafting Department

# Wage Payment Systems in Machine Shops

## A Review of the Methods of Wage Payment Generally Used in Machine-building Plants, Outlining Advantages and Disadvantages of Each

By W. D. STEARNS

Secretary of the Occupations and Rates Committee of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa.

IN modern industry it is the unit cost of production that determines whether or not a business is profitable. It does not matter how much a man receives per hour or per day, if his output is in proportion to his wages. The actual amount of wages paid is of secondary importance, as long as the unit cost of production is low. There are many plants that are so well organized that they pay high wages and yet have a low production cost; while other plants, more poorly organized, have a high unit cost of production in spite of the fact that they are paying low wages. It is often the case that the plants paying the highest wages make the biggest profits, because they are so well organized that the efforts of the men count to the highest degree.

### Factors Involved in Determining Wages

There are three factors involved in determining what the scale of wages ought to be. These are (1) the effect on the cost of production; (2) the effect on the employe; and (3) the possibility of applying a certain method of wage payment to the particular work in question. While there are a great many methods of wage payment, they can all be summarized into three main groups, as follows: (1) Paying a man for the *time* he spends at work; (2) paying for the *amount* of work done; and (3) sharing the profits of the work with the man. The first method is generally termed "day work"; the second is some kind of piece-work; and the third is a reward, not only for the employe's direct work, but also for faithful service over a specified period of time. It consists of an annual distribution of profits, and makes it necessary that the man should have been with the concern for a period long enough to be entitled to share in such profits. In modern industry, paying a man for the amount of work he does is becoming more and more common; its various modifications being known as straight piece-work, premium, task-and-bonus, and standard time systems.

**There are a number of different methods of paying for work done in a machine shop, each of which has its advantages and disadvantages. This article reviews different wage payment systems, and points out the fundamental principles involved in each system, showing why one may be superior to another under certain circumstances.**

### The Day-work Method of Wage Payment

In the past, it has been the common practice to pay a fixed hourly or daily rate. In the machine industries today, when this system is used, the unit is the hour. The disadvantages of the day-work system are that, when no records are kept of the time taken on individual operations, each man on the same class of work receives the same wage, regardless of the work that he does. Consequently, the more efficient worker finds that he receives little more than men who do less work than he. If he is given a higher rate, his fellow-workers will be dissatisfied. If adequate records are not kept to show differences in performance, an increase in the rates paid to a few men is likely to cause trouble. The more industrious men become discouraged, cease to put forth extra effort, and soon fall to the level of the less able workers. It was doubtless this system that brought about the organization of labor unions, because the only way in which a man could increase his earnings to any extent was by obtaining higher wages for a whole group of men engaged on the same class of work.

When records of the performance of each man are kept, it is possible to determine when wage increases are justified, even with day work. However, even then the increase in reward is not automatic, as it is under some form of piece-work, and there is no direct connection between the effort and the increased compensation.

### Advantages of the Day-work System of Wage Payment

On the other hand, the day-work system has several advantages, and in small plants employing not more than about one hundred men, where the manager is in close contact with

every employe, the day-work method may prove satisfactory. It has the advantage of simplicity in keeping the payroll; it is easily understood by the employe; and it is believed that the inspection expense can be reduced, because there is no incentive for the workman to hurry and thereby slight his work. When special care and accuracy are required in work which should not be hurried and which cannot be easily inspected, day work is doubtless the best method of paying for the service. There are certain jobs that require little more than the presence of the employe; these should also be paid by day rates. This class of work includes the operation of elevators, the firing of steam boilers, etc. There are also certain classes of work where the output is limited by the speed or the capacity of the machine and not by the effort of the operator; the day-work system is the one to employ in such instances. In addition, there are a number of cases where the work is not uniform in character, and where it is difficult to measure what would be a reasonable output in a given time. Patternmaking and toolmaking have been thought to come within this class, although, during recent years, some work of this kind has been placed on a piece-work, premium, or bonus basis, and this has resulted in increased earnings for the men and decreased labor cost for the manufacturer. In general, production will never rise to its possible limits under the day-work system. An incentive must be given for extra effort, and one of the piece-work plans of wage payment will furnish this incentive.

### Contract Systems of Wage Payment

The term "contract system" is used to include all systems in which the employe is paid for the *amount of work done* instead of for the *time spent* on the work. Any such system, to be successful, must provide all possible help to the employe in regard to machines, tools, materials, and instructions. The workman should be asked to perform only operations for which he has been especially trained, or with which he is familiar; while other labor should do the less important things in connection with the work, such as moving materials, getting tools, blueprints, etc. To obtain the best results, it is necessary that the employe be taught to perform the operations according to the methods determined by the careful study of experts. Furthermore, contract prices, when once established, should not be changed unless the methods of performing the operation are materially altered or unless there is a change in equipment or material.

Formerly, contract prices were established either from records of previous performances or from estimates by a foreman. Most of the dissatisfaction with contract rates on the part of the workmen has been due to incorrect prices determined in this manner without sufficient knowledge of the conditions. If the contract prices are cut as soon as a workman is able to earn a high wage, he naturally loses his desire to exert additional effort. He will make a studied effort to limit production to the maximum that he thinks is safe without having the price cut.

### Advantages and Disadvantages of Straight Piece-work

In straight piece-work the amount due the workman is determined by multiplying the number of pieces completed by a set price per piece. In this system all the saving in direct labor cost goes to the workman, while the employer benefits by the increased production and the resulting decrease in overhead cost per unit of work. The main advantages of the piece-work system are the facility with which costs can be determined in advance; the ease with which the payroll is kept; and the simplicity of the system to the workman. It is generally recommended that the straight piece-work system be applied only where the degree of skill is not an important factor, where the work can be inspected easily, where it is of a repetitive nature, and where the operations are few and simple.

The disadvantages of straight piece-work are: (1) It is difficult to apply when the operations are not fairly uniform over a considerable length of time; (2) it is not easily adjusted to take care of the fluctuations in the average price of labor; (3) it bears no relation to the value and the skill of the man, apart from his ability to perform a certain operation within a given time; (4) the employe is not guaranteed a minimum day's pay; (5) adjustments cannot be easily made to take care of conditions beyond the operator's control, such as failure of power, breakdown of machines, and poor material.

### Methods of Overcoming the Objections to Straight Piece-work

Various methods have been devised for overcoming some of the objections to straight piece-work. The fourth disadvantage, mentioned in the preceding paragraph, may be eliminated by establishing a day rate for each employe, which is guaranteed to him. If for any reason, he is unable to earn as much by piece-work as the equivalent of this guaranteed rate, then he is paid at the guaranteed rate instead of at the piece-work rate; in other words, he is always assured of a minimum pay per day.

A modification of the straight piece-work system is known as the differential piece-work method. This makes use of two piece-work rates for the same job. A standard time is established in which the job should be performed. If it is not performed in the standard time, or less, the lower of the two piece-work rates will be paid, but if it is performed in standard time or less, then the higher rate will be paid. In this way, an additional incentive is given for increased effort.

### Group System of Wage Payment

When a number of men work together, as in assembly work, it is difficult to pay piece rates to each individual. In that case it is an advantage to consider them as a group under a gang boss. A maximum labor cost is then placed upon the work to be performed by them. When the work is finished, the total earnings of the group will be equal to the sum of the day-rate wages of each man plus half the difference between their wages and the maximum labor cost estimated for the work. Each man's share in this additional bonus is proportional to his hourly rate and the number of hours that he has worked on the job. Generally the individual is guaranteed a day rate. This system is often used where the output of one workman is directly dependent upon the output of other men. Certain classes of foundry work, assembling operations, and riveting may be mentioned as examples of work which are adapted to the group system.

### Premium System of Wage Payment

In order to establish a premium system of wage payment, time studies are required for determining a standard time in which the work should be performed. This standard time should be the time required by an average operator working under average conditions. When the work is completed in less than the standard time, the operator is paid at a certain hourly rate—the premium rate—for the time saved, in addition to his regular rate. The premium rate generally varies from 25 to 50 per cent of the regular hourly rate.

As an example of this method, assume that the standard time for a piece of work is six hours, and that the workman is paid at the rate of forty cents an hour. Assume, further, that the premium rate is 50 per cent of the regular rate, or twenty cents an hour. If the man performs this work in six hours, he will be paid at his regular hourly rate, or $6 \times 0.40 = \$2.40$. If he performs it in four hours, he will be paid the hourly rate for four hours, and, in addition, the premium rate of twenty cents an hour for the two hours saved. His pay for the job would be $(4 \times 0.40) + (2 \times 0.20)$ or $1.60 + 0.40 = \$2$. This is for four hours' work, which makes his rate fifty cents an hour. His day rate is always guaranteed so that should he require more than six hours in which to perform the job, he will still be paid his regular hourly wage for the total time that he takes for the work.

The premium plan is a profit-sharing plan, under which the employer and the employe share in the gain from the increase in the output. The employer is justified in obtaining some of this gain, because the machines are used harder, and more power and supplies are employed. By dividing the profits, there is less incentive on the part of the employer to reduce the standard time in order to reduce the earnings of the workmen.

The most obvious advantage of the premium plan over the straight piece-work plan is that it permits of different hourly rates for different men, and hence has more flexibility. When hourly rates must be changed on account of changes in the labor market, the adjustments necessitated thereby are easily made, as the standard time remains the same and only the hourly rates of the men are changed. The greatest disadvantage of the premium plan is that it involves more accounting work, necessitates careful time study, and involves the keeping of many records.

### The Task-and-bonus Plan of Wage Payment

In the task-and-bonus plan the standard time is determined the same as in the premium plan, but instead of paying a premium rate for the time saved, a bonus (from 25 to 50 per cent of the total wage paid for the standard time) is allowed the operator, if he completes his task in standard time or less. For example, suppose the standard time is six hours and the hourly rate forty cents. If the workman completes the work in five hours he will still be paid for the full standard time, $6 \times 0.40 = \$2.40$, and in addition, a bonus of 25 per cent of this, or 60 cents. A guaranteed day rate is always used in connection with this plan.

### The Standard Time-rate Plan of Wage Payment

After having studied and used all the preceding methods of wage payment, and taken into consideration the advantages and disadvantages of each, the Westinghouse Electric & Mfg. Co. has decided to try, in some departments, a plan which differs somewhat from those ordinarily employed in other machine manufacturing plants. This new plan involves the following three principles:

1. Careful time studies to establish a standard time, which is the time in which an average man, under average conditions, can perform the work.

2. A day rate, which is a fair amount for the class of work under consideration in the locality in question. This should be equal to the day rate that would be paid for similar work if no other system of wage payment were used.

3. The application of a standard time rate, which is a definite percentage higher than the day rate.

In practice, this system works as follows: If the work is performed in standard time or less, the employe is paid the standard time rate multiplied by the number of hours of standard time allowed for the job. If he does not perform the work in standard time, he is paid his day rate multiplied by the number of hours required for the job. As an example, suppose that the standard time is six hours and the day rate is forty cents per hour. The standard time rate may be taken as 10 per cent higher than the day rate, or forty-four cents per hour. If the work is performed in five hours, the employe will be paid $6 \times 0.44 = \$2.64$, or fifty-three cents an hour. If it is performed in six hours, he will still be paid $2.64, or forty-four cents an hour; but if it is performed in seven hours he will be paid only his day rate, or forty cents an hour.

When this system is employed, it is important that records be kept of every case where a man is unable to perform the work in standard time, and that special records be made out by the time clerk and sent to the time-study man for investigation. After the investigation, the time-study man reports to the superintendent the reason why the operator failed to perform the work in standard time. When this system is analyzed, it will be found that, if the employe is able to perform the work in standard time or less, he works on a straight piece-rate basis; but if he requires more than standard time for the performance of the job, then he works on a straight day-rate basis.

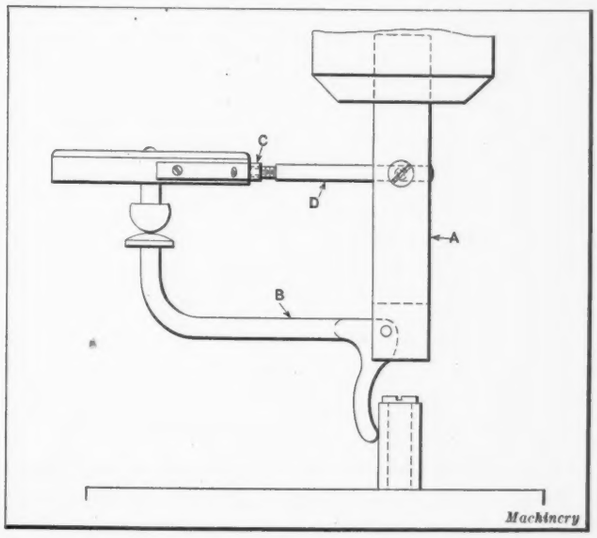
The principles upon which this scheme is founded are thought to be fundamentally correct. The two most important of these are a high day rate and a low incentive. All new employes have to begin on the day-work basis while learning the job. If the day-work rate is low, then one cannot expect to get the right type of man to undertake the job. A special instruction-period day rate, higher than the regular day rate, is only a makeshift, for when the employe becomes proficient, it does not seem fair to him that his day-work rate should be decreased. A high day rate is also needed on special short jobs, repair jobs, and instruction work, where a standard time cannot be easily established. Again, if a comparatively high incentive is allowed—perhaps from 30 to 50 per cent above the high day rate—as soon as the worker becomes familiar with the work, his earnings are out of all proportion to the value of his services. He realizes this and tends to curb his production, so that his earnings may seem reasonable. When a lower incentive is adopted, care must be taken that the employe is aided in every possible way to work efficiently. This means that all retarding influences must be discovered and removed.

The system is only the tool. Its success or failure depends principally upon its being properly handled and supervised.

* * *

## DIAL INDICATOR FOR TRUING BUTTONS

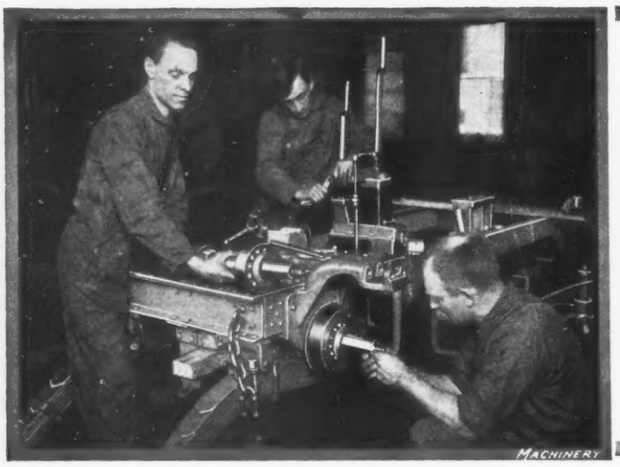
The accompanying illustration shows an arrangement by means of which a dial indicator is attached to the spindle of a vertical milling machine for the purpose of truing up buttons when locating them on a jig plate, or similar work. Since the dial is always visible to the workman, this method overcomes the objection of the operator being required to follow the indicator around and to move to a new position with every reading.




Dial Indicator used on Vertical Milling Machine for truing Buttons

The shaft *A* which is held in the milling machine spindle is slotted and drilled at its lower end for the purpose of attaching the lever arm *B* by means of a pin. This arm is bent on the indicator end as shown, and is flattened where it fits into the slot in shaft *A*, so that it may operate freely. The strap *C* is bent to conform to the outside of the indicator case to which it is either soldered or fastened by screws. The strap has a tapped hole to receive the threaded end of the arm *D*, the opposite end of the arm being fitted into a hole in the shaft, where it is secured by a machine screw. The device, except the indicator itself, may be readily and economically made. The degree of accuracy which may be obtained can be increased to suit the requirements by simply lengthening the lever *B*.

Bridgeport, Conn. R. S. MYERS



# Terms Used in Interchangeable Manufacturing

By EARLE BUCKINGHAM

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IN order to describe concisely characteristics peculiar to interchangeable manufacturing, it is necessary to use many words and phrases in an arbitrary sense. Therefore, to avoid misunderstanding, space is taken here to define several of the important terms. The interpretation of these terms is limited to the ideas they express in this series of articles.

### Interchangeability, Selective Assembly, and Function

*Interchangeability*—The term interchangeability, as used here, refers to absolute interchangeability. In this sense, interchangeable parts are parts that are so made that they can be assembled or interchanged after final inspection without machining or fitting, and any possible combination of these parts will assemble, interchange, and function properly. To insure this end, the most extreme limits permitted must be constantly checked against each other.

*Selective Assembly*—Selective assembly refers to a method of manufacturing similar in many of its details to interchangeable manufacturing, in which component parts are sorted and mated according to size and assembled or interchanged with little or no machining. Companion parts made to the extreme limits are not supposed to interchange. For instance, a maximum male component will not assemble with a minimum female part. However, the maximum male and female, or the minimum male and female must interchange. A good example of this method of assembling is found in the production of ball bearings. The balls are sorted into groups, according to their size, to facilitate the assembly of any bearing with balls of uniform size. As a matter of fact, nearly every so-called interchangeable article represents a combination of the two methods of quantity production—interchangeable and selective.

*Function*—The term function is used extensively and with various shades of meaning. The word itself has many meanings. The dictionary gives one as "fulfillment or discharge of a set duty or requirement"; and another as "that mode of action or operation which is proper to any structure," etc. As applied to component parts, the word has been used to express both these meanings. This includes all requirements of interchangeability and service which the part must render throughout the normal life of the mechanism of which it forms a part. The same meaning is intended when it is applied to the assembled mechanism. The functional design refers specifically to the combination of mechanical movements required to make the completed mechanism perform its specified duties. Functional gages are those which test the functional operation of components without strict adherence to their exact physical dimensions.

### Limit and Tolerance

*Limit*—In every interchangeable mechanism there are certain maximum and minimum sizes for each part, between which the parts will function properly in conjunction with each other and outside of which they will not. These sizes are the absolute limits of the parts. The established limits are the maximum and minimum dimensions specified on the component drawings. The established limits should approach as closely to the absolute limits as normal manufacturing conditions require. Limits established without regard to the absolute limits result either in excessive cost of manufacture or faulty mechanisms or both. If the established limits are much more severe than the absolute limits, needless expense is incurred in manufacturing. On the other hand, if the established limits are more liberal than the absolute limits, unsatisfactory mechanisms will be produced.

*Tolerance*—Tolerance is the amount of variation permitted on dimensions or surfaces. The tolerance is equal to the difference between the maximum and minimum limits of any specified dimension. For example, if the maximum limit for the diameter of a shaft was 2.000 inches and its minimum limit was 1.990 inch, the tolerance for this diameter would be 0.010 inch. By determining the maximum and minimum clearances required on operating surfaces, the extent of these tolerances is established. The application of the tolerances to the basic dimensions fixes the limits.

### Basic and Model Size

Obviously, the absolute limits of the various dimensions and surfaces indicate danger points, inasmuch as parts made beyond these limits are unserviceable. A careful analysis of a mechanism shows that one of these danger points is more sharply defined than the other. For example, a certain stud must always assemble into a certain hole. If the stud is made beyond its maximum limit, it will soon be too large to assemble. If it is made beyond its minimum limit, it will be too loose or too weak to function. The absolute maximum limit in this case can be defined within a range of 0.001 inch, whereas the absolute minimum limit cannot be defined within a range of at least 0.004 inch. In this case the maximum limit is the more sharply defined.

*Basic Size*—The basic size expressed on the component drawing is that limit which defines the more vital of the two danger points, while the tolerance defines the other. In general, the basic dimension of a male surface is the maximum limit which requires a minus tolerance. Similarly, the basic dimension of a female surface is the minimum limit requiring a plus tolerance, as shown in Fig. 1. There are, however, dimensions which define neither a male nor a female surface. Such are dimensions for the location of holes. In a few cases of this kind, a variation in one direction is less dangerous than a variation in the other. Under these conditions, the basic dimension represents the danger point, and the tolerance permits a variation only in the less dangerous direction. At other times, the conditions are such that any variation from a fixed point in either direction is equally dangerous. In such a case, the basic size represents this fixed point. Tolerances, when given on the component drawing, extend equally in both directions.

*Model Size*—If a model is developed as a standard of precision, the model parts become the physical representations of the basic sizes. In other words, for all practical purposes, the model size and the basic size are identical.

### Maximum and Minimum Metal Sizes

*Maximum Metal Size*—Maximum metal size is that limit at which the part contains the maximum amount of metal. This would be the maximum male limit and the minimum female limit. In many cases, a careful analysis is necessary to determine which limit represents the maximum metal conditions, as many dimensions are neither male nor female. In other cases, such as locations of holes, there are neither maximum nor minimum metal conditions. With few exceptions, however, the maximum metal sizes are also the basic sizes.

*Minimum Metal Size*—Similarly, the minimum metal size is that limit at which the part contains the minimum amount of metal. This is the minimum male limit and the maximum female limit, when the dimensions can be so classified.

### Minimum and Maximum Clearance—Interference

*Minimum Clearance*—It is evident that there must be a definite amount of clearance between male and female components which operate together. The minimum clearance should be as small as will permit the ready assembly and operation of the parts, while the maximum clearance should be as great as the functioning of the mechanism will allow. The difference between the maximum and minimum clearances defines the extent of the tolerances. On companion elementary surfaces, the difference between the maximum male limit and the minimum female limit determines the minimum clearance, as shown in Fig. 2. On composite surfaces, careful study is required to determine which limit should be used. In fact, it is impossible in certain cases to have the minimum clearance conditions at all points at the same time. In general, however, the comparison of the basic sizes of companion parts gives the minimum clearance conditions.

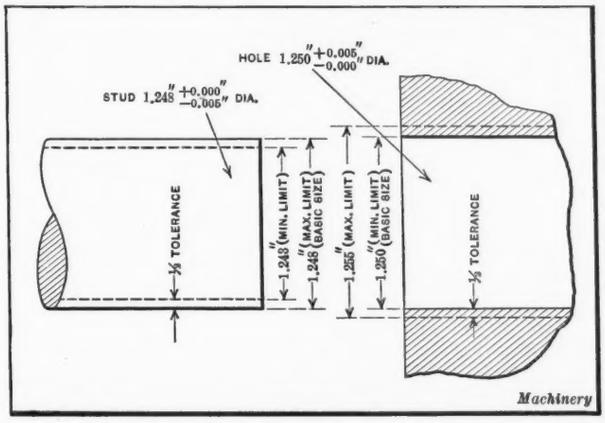



Fig. 1. Graphic Illustration of the Meaning of the Terms Limit and Tolerance

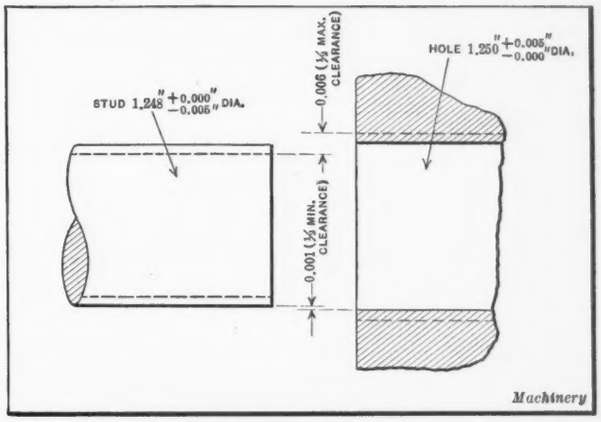



Fig. 2. Graphic Illustration of the Meaning of the Terms Maximum and Minimum Clearance

*Maximum Clearance*—On elementary surfaces, the difference between the minimum male limits and the maximum female limits establishes the maximum clearances. In general, the terms maximum or minimum clearance refer only to the clearance between surfaces which operate together or within close proximity to each other. When surfaces stand well clear of each other, and there is little or no danger of interference, as between unfinished forged or cast surfaces, the matter of maximum and minimum clearance plays little part in determining the tolerances.

*Interference*—If a male member is larger than a female member, it is obvious that there will be interference when these parts are assembled together. Such interference is required where force fits are specified. If interchangeable parts are to be forced together, this interference performs a similar function to that of clearance on operating surfaces. In this case, the minimum interference establishes the danger point. This means that for force fits the basic male dimension is the minimum limit requiring a plus tolerance, while the basic female dimension is the maximum limit requiring a minus tolerance. (See Fig. 3). When the component drawings permit an interference where a clearance is required, they are wrong. The term interference is often used to express such conditions of error.

### Operating, Functional and Clearance Surfaces—Atmospheric Fits

*Operating Surfaces*—The term operating surface is used to distinguish the working surfaces of the mechanism from the others. It is clear that the working surfaces are the essential ones; all others are present only because of the necessity of holding the mechanism together. Generally speaking, the operating surfaces are the machined surfaces, while the others often retain their original forged or cast finish. The operating surfaces are divided into two classes, which are designated functional and non-functional, or clearance, surfaces.

*Functional Surfaces*—The functional surfaces are those operating surfaces which control the functioning of the mechanism, as shown in Fig. 4. These must naturally be held to the closest limits. Every operating part of a mechanism must be controlled in operation within reasonably close limits in each plane. After these functional requirements of location are met, all other surfaces should have as large clearances as possible, unless the factor of strength is the controlling one. Those surfaces that affect the relative location of the operating parts in operation are the functional surfaces. For example, the surface of a pad on which a bracket that carries operating parts is fastened is a functional surface; whereas, the surface of a pad that supports a bracket for holding wrenches or oil-cans is not.

*Clearance Surfaces*—Clearance surfaces are those operating surfaces which are not functional surfaces. In this class are surfaces which do not control the location of operating members while functioning, but which either prevent them from being disassembled or locate them approximately in their inactive position, or both.

*Atmospheric Fits*—Atmospheric fits, as the name implies, refers to those surfaces which, under all conditions, stand entirely clear of any other operating or functional members of the mechanism. Such is the outside of a machine frame. Many surfaces on operating parts are themselves also atmospheric fits. With few exceptions, the majority of the surfaces of all mechanisms are atmospheric fits.

### Elementary and Composite Surfaces—Compound Tolerances

*Elementary Surfaces*—An elementary surface is one which is defined with a single dimension, such as a cylinder, a plane, or a sphere. For example, a reamed hole of a specified depth represents two elementary surfaces. The diameter defines one and the depth the other. Obviously, most surfaces which are not elementary in themselves are a combination of elementary surfaces. In so far as such surfaces are machined and measured according to their elements, they are considered elementary surfaces. When the combination as a whole is measured or machined, and a varia-

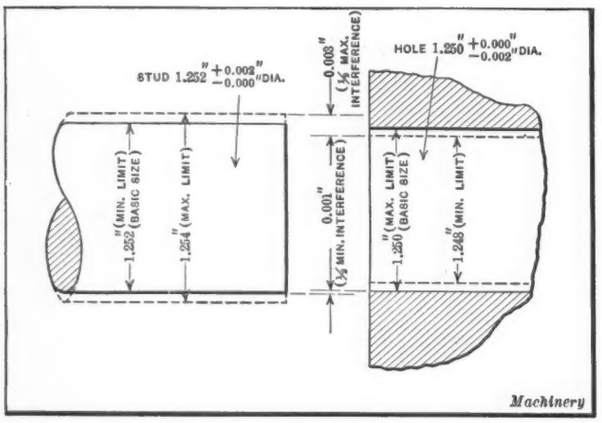



Fig. 3. Graphic Illustration of the Meaning of the Terms Maximum and Minimum Interference

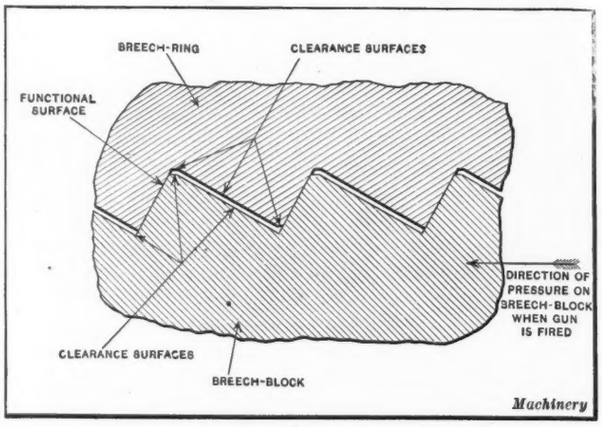



Fig. 4. Illustration showing the Meaning of the Terms Functional and Clearance Surfaces

tion on one surface affects the dimension of another, they are not elementary but composite surfaces.

*Composite Surfaces*—Composite surfaces are those surfaces which are required to maintain a co-relation which cannot be expressed by a single dimension. For example, Fig. 5 shows a yoke end. The over-all dimension (2.500 inches) controls elementary surfaces. The dimension of the slot (0.750 inch) and that of its location (0.875 inch) also define elementary surfaces when used independently. If, however, surfaces marked *A*, *B*, and *C* are required to be checked concurrently, these elementary surfaces become composite. Irregular profiles, the co-relation of several holes to each other, tapered surfaces, thread sizes and forms, the contour and location of gear teeth, etc., are examples of more complicated composite surfaces than the example shown in Fig. 5.

*Compound Tolerances*—A compound tolerance refers to those conditions where the established tolerances on more than one dimension determine the required limits. These exist in conjunction with the dimensioning of composite surfaces. For example, a compound tolerance exists in establishing the location of surface *C* in Fig. 5 from surface *A*. This condition of compound tolerances will be covered in greater detail in a subsequent article.

### Working or Register Points

*Working or Register Points*—The working or register points are those surfaces that are employed for locating the parts in the jigs and fixtures during the process of manufacture. Sometimes important functional surfaces are used for this purpose. In other cases, for parts of irregular form, special lugs are provided to serve this end. These are removed after the machining operations are complete. Register points become functional surfaces when they are employed to machine other functional surfaces. As few locating points as possible should be established; this practice simplifies the design of the gages and other equipment.

### Unit Assembly

*Unit Assembly*—Many mechanisms are a combination of several semi-independent mechanisms which may be assembled and tested individually before they are assembled together. This is known as unit assembly; it is of particular value for a plant which manufactures a varied product where such unit assemblies are interchangeable. An example would be a feed-box that could be used on several types of machines. This practice enables a plant to obtain the benefits of quantity production on these unit assemblies although the quantity of production on any one type of machine is small.

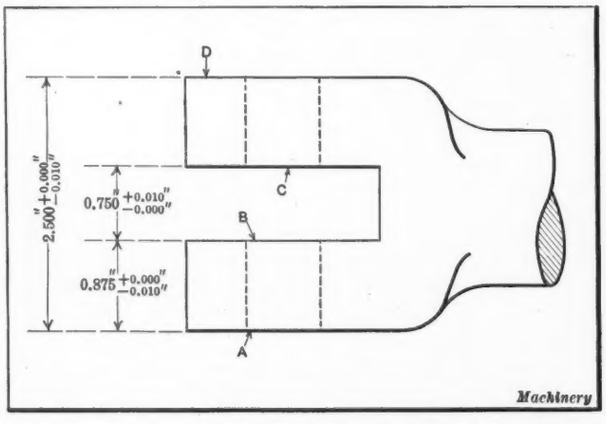



Fig. 5. Illustration showing the Meaning of the Terms Elementary and Composite Surfaces

### Precision and Accuracy

*Precision*—There are two characteristics pertaining to the physical dimensions of the parts manufactured. For purposes of discussion, we will call them precision and accuracy. The two are often considered identical, and if ideal conditions could be maintained, they would be identical. In ordinary manufacturing practice, however, precision alone is usually obtained, and precision is all that is necessary in most cases. It is when several factories attempt independently to produce a common interchangeable product that accuracy is required. The degree of precision is measured by the amount of variation that exists between duplicate parts. For example, a reamed hole is dimensioned as 0.500 inch in diameter. In manufacture, a product is obtained in which the difference between the largest and smallest holes produced does not exceed 0.005 inch. The degree of precision in this case would be 0.005 inch, even though the absolute size of the largest hole was 0.508 inch.

*Accuracy*—The accuracy of any determination is measured by its limit of error from a fixed standard. For example, a length of one inch is to be measured. We will assume, for the sake of argument, that the measuring instruments are absolute. This length measured with an ordinary steel scale gives a result correct within a limit of error of about 0.01 inch. If measured with a micrometer, the result is correct within a limit of error of about 0.005 inch. If measured on a sensitive measuring machine, the result is correct within a limit of error of about 0.00001 inch; while if measured by optical methods, advantage being taken of the principle of interference of light waves, the result is correct within a limit of error of 0.000001 inch or less. It may be of interest to note here that the United States legal standard of length has been defined by the Bureau of Standards in terms of light waves. By this means, an absolute standard is established, since the lengths of light waves are absolute. The term accuracy implies a comparison with a fixed standard. In the example given to illustrate precision, the limit of precision is 0.005 inch, while the limit of accuracy is 0.008 inch. It is obvious from this that it is more difficult to maintain a limit of accuracy of 0.001 inch than it is to maintain a limit of precision of the same amount.

### Component and Operation Drawings

*Component Drawings*—Component drawings are detailed drawings of the component parts of a mechanism. For interchangeable manufacturing, these drawings show the completed dimensions required (or inspection gage requirements) of the parts. These include all tolerances and any sub-assemblies that may be necessary to assist in their proper interpretation.

*Operation Drawings*—An operation drawing is a detailed drawing or sketch which gives the dimensions required on an individual machining operation. These drawings are used to record much supplementary information that might be confusing or misleading on the component drawings, such as allowances for finishing cuts and grinding operations, etc.

* * *

## SHEARING TOOL FOR CUTTING OFF TUBING

By F. A. STOYE

An appliance that is used in connection with a punch press for cutting-off operations on special lengths of tubing is illustrated herewith. The tubing is 4½ inches outside diameter and 3¾ inches inside diameter, and is cut into pieces 4⅞ inches long from tubing varying from 18 to 22 feet in length. The device and a piece of tubing are shown in section in Fig. 1 after a cutting-off operation has been performed. The sliding blade-holder *A*, and the shoe or stationary blade-holder *B*, both of which are made of cast iron, carry the blades *C*, which are made of tool steel and are hardened. The faces of the blades and the surfaces adjacent to the tubing are ground, it being the practice to reverse the blades before regrinding them. Plug *D* is made of machine steel and has a hardened and ground tool-steel face *E* secured to it as shown. The handle *F* is a piece of one-inch pipe screwed into plug *D*, and is of sufficient length to project beyond the end of the tubing. The sliding plug *G* is also made of machine steel, and has a hardened and ground tool-steel face *H* secured to it similar to plug *D*. The face *H* has a very slight boss that affords a sufficient amount of clearance between the edges of the two tool-steel faces *H* and *E*. The gate *J* is a steel forging upon which ways have been machined to allow the slide which carries plug *G* to move freely. This slide is held in the milled way by the gibs *P*. From Fig. 2 it will be seen that the gate *J* is hinged on stud *R* and must be opened to permit of removing the severed piece of tubing. The gate is clamped in the closed position by means of the connecting link *S* which is hinged on the stud *U* and the eccentric cam-lever *T*.

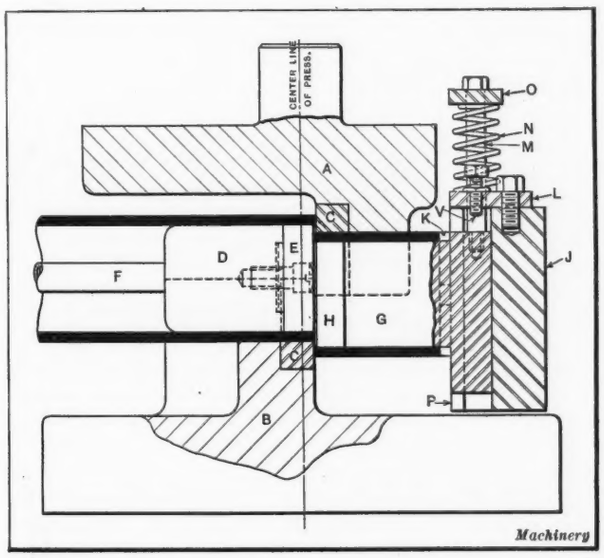



Fig. 1. Sectional View of Device for shearing Tubing

Referring to Fig. 1, it is obvious that when gate *J* is closed, the face of *E* is held against the face of *H*, and the tubing may be pushed over the two plugs and against stop *K*. When the press is tripped, plug *G* will be forced downward with the travel of the ram, and as the ram returns to its original position, plug *G*, carrying the severed piece of tubing, will also be returned to its former position as determined by the adjusting screw *V*, by means of springs *N*. These springs are held between strap *O* and plate *L* by means of the bolts *M*. On account of the semicircular shape of the shearing blades, it is necessary that the blade-holder *A* be raised sufficiently so that the plug *G* with its severed piece of tubing may swing clear of *B* when the gate *J* is opened for unloading the plug. A travel of the press ram of about ⅝ inch is required to cut the tubing completely after the blade comes into contact with the work, and about 100 tons pressure and two men for loading and unloading are needed for the operation.

* * *

## UNITED STATES IRON AND STEEL TRADE WITH JAPAN

The American trade with Japan in iron and steel has increased during the war to a phenomenal extent according to figures published in a recent number of the *Iron Age*. Although this increase is apparent in many products, it is particularly striking in the case of steel plates and sheets, tin plate, and machinery. In 1913 Japan took only 7250 gross tons of American steel plates and sheets, but in 1918 that country received 120,395 tons of steel plates and 53,862 tons of sheets or 174,257 tons of both, which was equivalent to twenty-four times the pre-war consumption. Japan's absorption of steel plates was still more striking at the height of the war. In 1917, out of total exports of 525,660 tons of steel plate from the United States, Japan was credited with 257,709 tons or about 50 per cent. In tin plate and machinery the trade with Japan has also shown a marked increase. In 1913 Japan received from the United States only 227 tons of tin plate; in 1918 this amounted to 36,643 tons. The export value of all metal-working machinery shipped from the United States in 1913 was $15,558,212, and in 1918 it was $51,620,297. Japan's share in 1913 is not recorded, but in 1916 exports of metal-working machinery to Japan were valued at $801,449, and in 1918 they were equal to over $4,000,000. Japan's imports of rails were four times greater in 1918 than in 1913, and the use of cast and wrought pipe and fittings from 1916 to 1918 expanded over threefold. In the non-ferrous field the increase in Japanese buying has been significant. The exports of spelter to Japan in 1916 amounted to 149 tons and in 1918 had increased to 3378 tons.

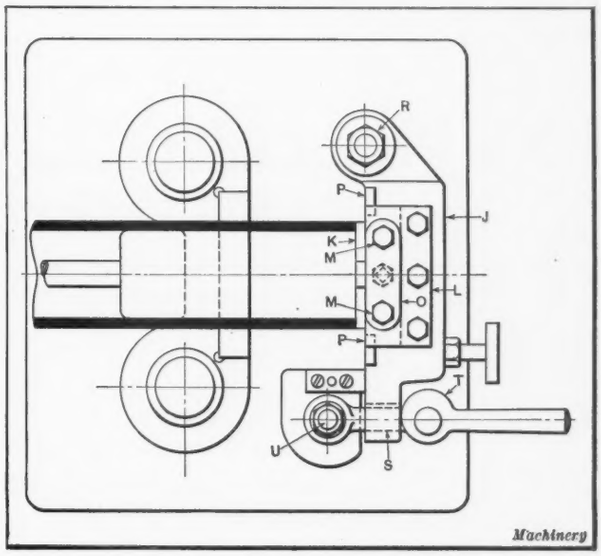



Fig. 2. Plan View of Tube Shearing Device shown in Fig. 1

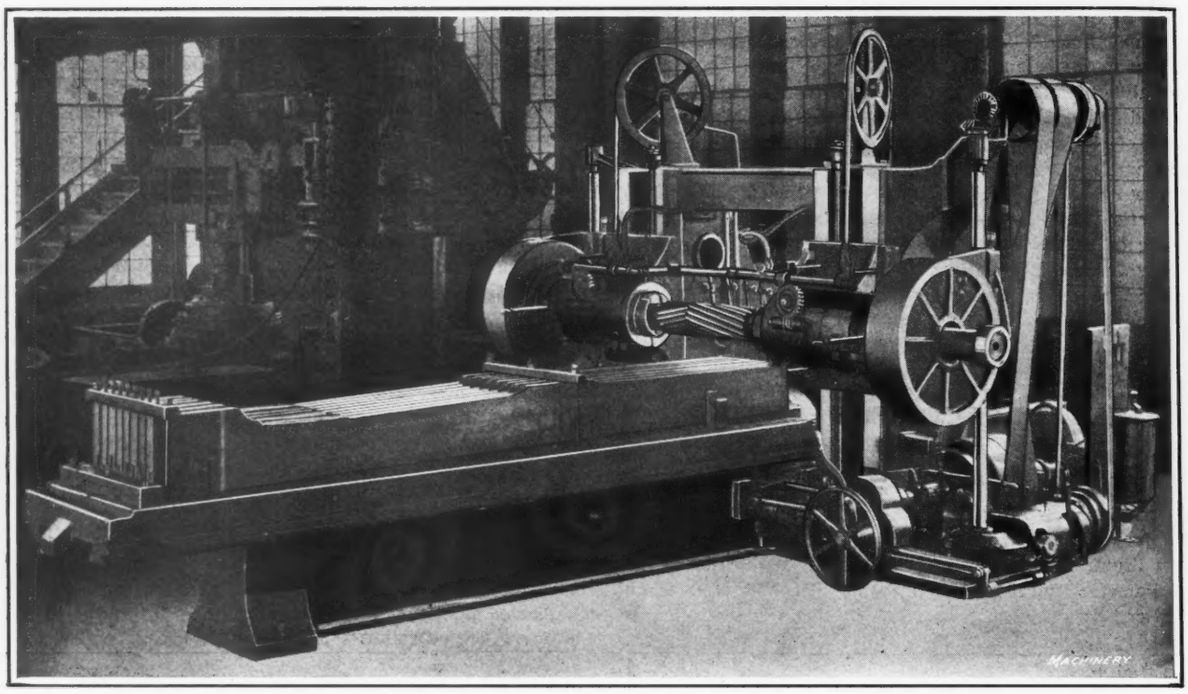


Fig. 1. Slabbing Type of Milling Machine equipped for milling Edges of Locomotive Engine Side Frames

# Milling Practice in Locomotive Shops

## Methods of Milling Heavy Forgings for the Side-rods, Connecting-rods and Side Frames of Locomotives

By EDWARD K. HAMMOND

ENGINEERING works which are engaged in building locomotive engines have a number of heavy-duty milling operations to perform on parts of their product. Among the more severe of these, are operations required on forgings for connecting-rods and side-rods. Figs. 1 to 7, inclusive, show some of the typical milling operations for which the multiple-spindle or so-called "slabbing" type of milling machines, built by the Bement-Miles Works of the Niles-Bement-Pond Co., 111 Broadway, New York City, are used in several of the more prominent locomotive shops in this country. In this connection, it may be mentioned that some of these milling operations performed in locomotive shops are among the most severe classes of service that are required of milling machines. This is true of both the rate at which metal is removed by the cutters, and the toughness of the forgings to be milled.

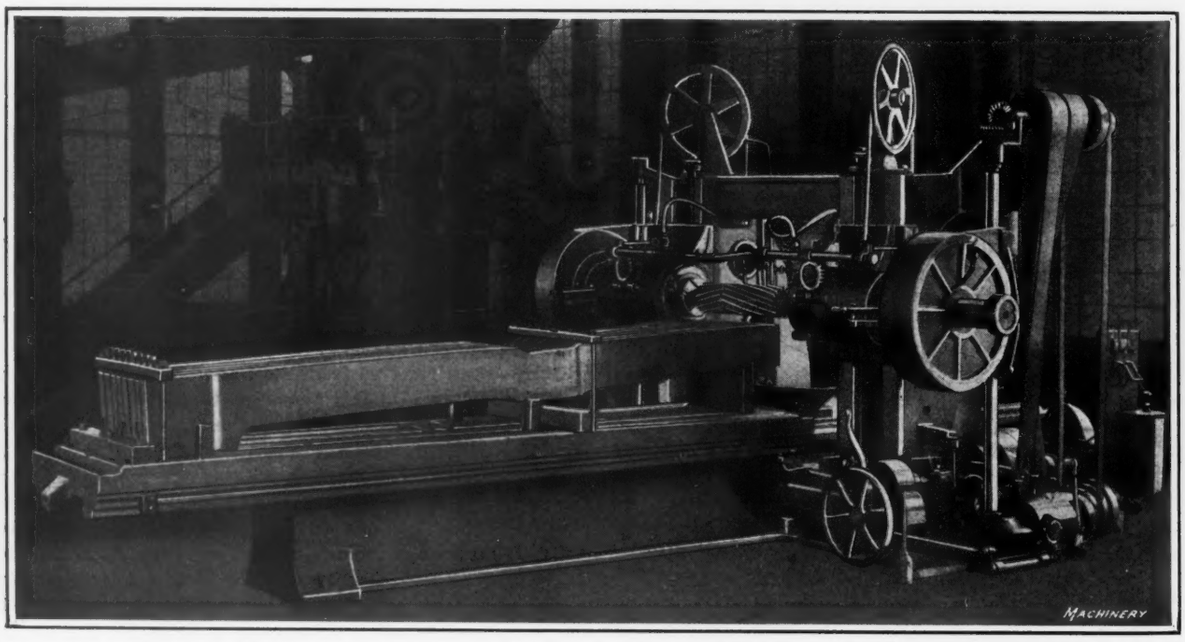


Fig. 2. Slabbing Operation on Same Locomotive Side Frames that are shown in Fig. 1, but with the Work turned over for milling Opposite Edges

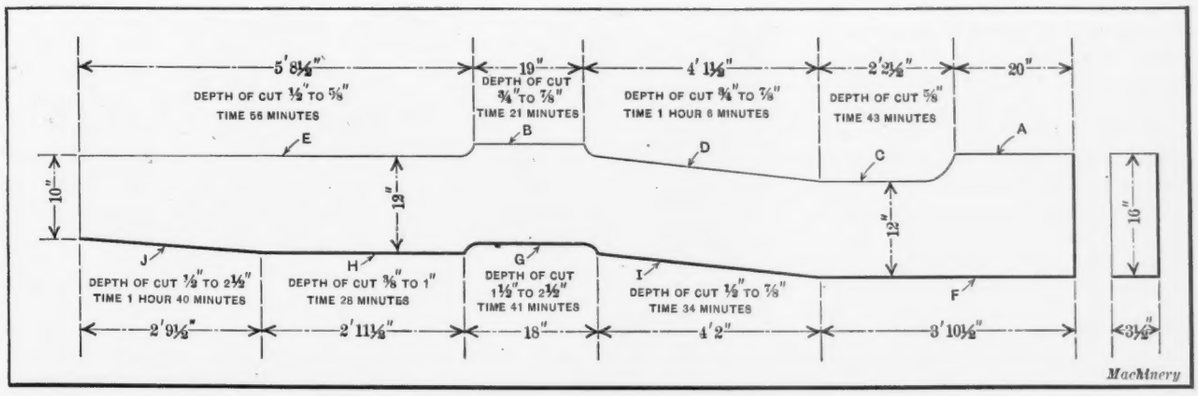



Fig. 3. Design of Locomotive Side Frames which are shown being milled in Figs. 1 and 2

### Slabbing Operations on Locomotive Side Frames

Figs. 1 and 2 show two of the operations which are required for the milling of locomotive side frames from the forgings. The finished piece is illustrated in Fig. 3 and by reference to this illustration in connection with the following description, an idea will be obtained of the exact nature of the work that must be done in order to complete the machining of these parts.

After setting up four forgings on the machine, the first step is to provide for milling faces *A*, *B*, and *C* in the order named, and after this has been done, surfaces *D* and *E* are the next to be milled. In handling work of this general character on a slabbing type of milling machine, it is possible to use the machine for sinking the cutters to the required depth in the work, in addition to feeding the work under the cutters. Obviously, the power mechanism provided for traversing the cross-rail on the housings is utilized when it is required to sink the cutter into the work. This was also the method of procedure adopted to provide for forming the curved shoulder, or "radius," between surfaces *A* and *C*, and also between surfaces *B* and *D*, and *B* and *E*.

As faces *A*, *B* and *C* are parallel to the under side of the forging, the four pieces of work can be set flat on the machine table for the milling of these surfaces. Next in the sequence of operations comes the machining of surface *D* on each of the four side frames. It will be evident from Fig. 3 that this surface is inclined to face *C* and so special means must be provided for obtaining the required angle. This is easily done by blocking up the work at one end in order that traversing of the forgings under the cutters may result in milling surface *D* on each forging in the desired relationship to other finished faces. As in the preceding case, it is necessary to sink the cutter into the work in order to produce the required radius between faces *B* and *D*. After finishing this milling operation, the blocks are removed in order to drop the forgings back to a position flat on the table, and the cross-rail must next be raised to allow sufficient clearance to pass the central work-holding clamps beneath the cutters. The cutters are then sunk into the work to the required depth, after which the feed is engaged to provide for milling surface *E*. This completes the operations which are performed with the forgings held in the position shown in Fig. 1.

On the opposite edge of the forgings, as milled when set up on the machine shown in Fig. 2, there are three parallel faces *F*, *G* and *H*, and two inclined faces *I* and *J*. For finishing the parallel faces, the work is located from the two parallel faces *A* and *B*, which were finished during the preliminary slabbing cut that was taken across the opposite edge of the forgings when they were set up on the machine shown in Fig. 1. A similar slabbing cut is taken across the work after it is set up on the machine shown in Fig. 2, and this results in finishing face *F*. The work is next blocked up to the required position for milling inclined face *I*, after which the blocks are removed to relocate the forgings from faces *A* and *B*. Then the cutter is sunk to the required depth, and surface *G* is milled, care being taken to trip the power feed at exactly the desired point to produce the re-

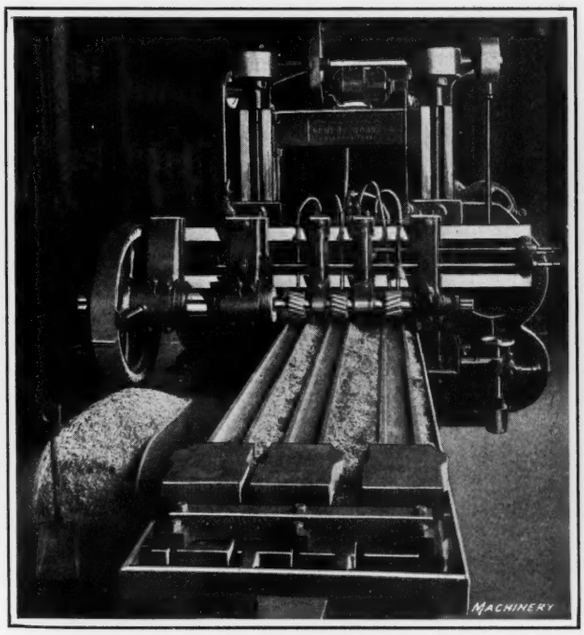



Fig. 4. Slabbing Type of Milling Machine equipped for the Performance of Channeling Operation on Locomotive Connecting-rods

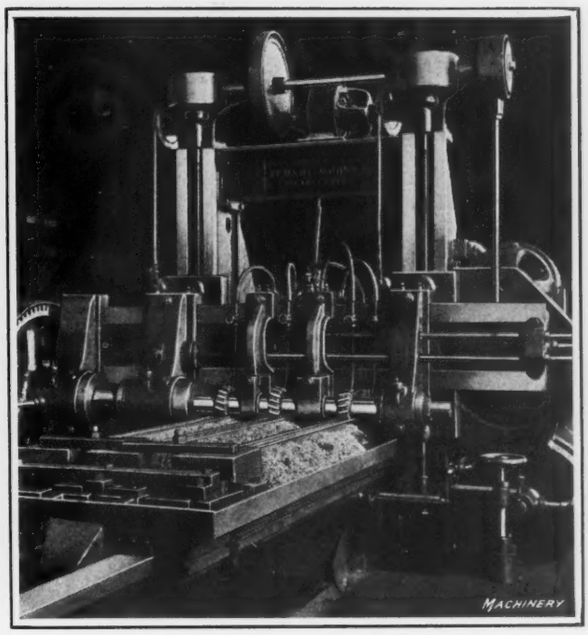



Fig. 5. Close View of the Work and Cutters on the Slabbing Type of Milling Machine shown completely in Fig. 4

quired "radius" at the opposite end of this face. The cross-rail is next reset in the proper position for milling face *H*, after which the forgings are blocked up to the position shown in Fig. 2 ready for milling inclined surface *J*, which completes the operations required on the edges of the work. There are other milling operations to be performed on the sides of the work and subsequent machining operations, but a discussion of this work does not come within the scope of the present article. A good idea of the amount of service that is obtained from the milling machines used on the work shown in Figs. 1 and 2, will be gathered from the fact that approximately 1356 pounds of steel is removed from the edges, and the length of time required to do this work is six hours and twenty-nine minutes. The depth of cut taken on each face of the work and the time occupied in milling each face are shown in Fig. 3.

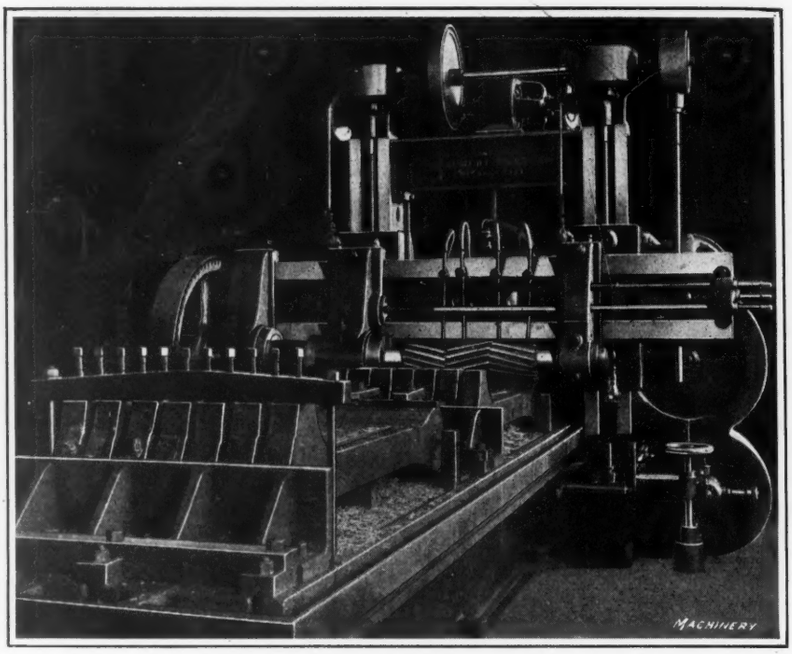



Fig. 6. Slabbing Type of Milling Machine equipped for simultaneously milling Edges of Seven Locomotive Engine Side-rods

### Fluting or Channel-milling Operations on Connecting-rods

Forgings from which locomotive engine connecting-rods are to be machined are brought to the desired form through following the same general method of procedure that was described for the milling of side frames. Consequently, it is unnecessary to enter into a detailed description of the preliminary operations which are performed before attention is called to Figs. 4 and 5, which show the performance of what is variously known as the channeling or fluting operation. It will be seen that three cutters are provided for milling the channel in three forgings which are set up on the machine at a time. For the performance of these channeling operations, the machine cannot be operated under as severe conditions of speed and feed as in the case of plain slabbing operations, because it is more difficult to dissipate the heat generated by the cutters, owing to the fact that they are more closely surrounded by the metal.

The method of setting up these forgings for milling the channels will be fairly apparent from the illustration; but at this point it will be of interest to outline the conditions of speed and feed, and the time which is allowed by one well-known locomotive plant for the performance of this operation. On the connecting-rods which are shown in process of milling, the channels are 4 1/2 inches wide by 1 25/32 inch deep by 10 feet long; and the forgings are made of 45- to 50-point carbon steel. For the performance of the channel-milling operations, the rate of feed employed is from 2 1/2 to 3 inches per minute, this being all that the milling cutters will stand without excessive wear. In this plant, a feed of 5 1/2 inches per minute has been employed with a cutting speed of 80 feet per minute, but operating under such severe conditions, it was found that the rapid wear of the milling cutters more than offset the improved rate of production. Operating with a feed not exceeding 3 inches per minute, the milling cutters are good for three settings, that is to say, for milling the flutes on both sides of nine connecting-rods, before they require grinding. On this channel-milling operation, the time required to complete three rods is twelve hours, this figure representing the time from floor to floor. It is found economical to take two cuts in each channel, the first being 1 1/8 inch in depth and the second 21/32 inch in depth, giving the required total of 1 25/32 inch.

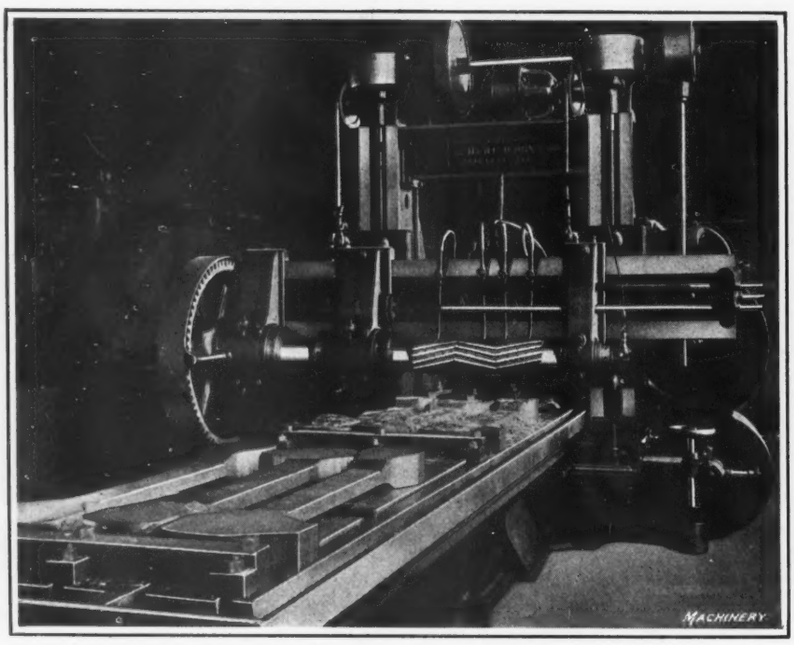



Fig. 7. Locomotive Engine Side-rods shown in Fig. 6 set up for the Simultaneous Performance of Slabbing Operation on the Flat Sides of Three Pieces of Work

### Slabbing Operations in Milling Locomotive Side-rods

Planer type milling machines, built by the Bement-Miles Works of the Niles-Bement-Pond Co., are used in a number of plants for milling the side-rods that connect driving wheels of locomotive engines. Figs. 6 and 7 show two of this company's machines set up for the performance of slabbing operations on the edges and flats of side-rod forgings. For the milling operation on the edges of the work, it will be apparent that fixtures are employed which have sufficient capacity for setting up fourteen forgings at a time; and by utilizing the power feed mechanism for the cross-rail, provision is made for milling the rods to the desired form. The fixtures used for holding these parts on the milling machine table are of no special interest, as it will be seen that they consist merely of end blocks for supporting the thrust of the cutters, and

straps at each end for holding the forgings down on the fixture. However, it will not be out of place to call attention to the fact that after one side of the forgings has been milled and the work turned over ready for performing the second operation, it is found necessary to place a supporting block under the work at the center, as shown in Fig. 7, in order to avoid danger of having the pressure of the cut spring the forgings.

For the purpose of facilitating production on this work as far as possible, a method has been devised for setting up the forgings on the machines shown in Figs. 6 and 7, which is the means of greatly reducing the idle time of both the machines and their operators. It will be observed that on the machine set up for milling the edges of the forgings, two rows of seven pieces each are mounted on the table; and when the pieces are set up for milling the side faces, two rows of three forgings each are set up ready for performing this operation. It must not be understood, however, that this is in any sense an application of "string" fixtures, because a very brief inspection of the illustrations will make it apparent that it is impracticable to continue the feed movement of the table in order to bring the second row of forgings under the milling cutters. The method of procedure actually followed in loading and unloading the fixture shown on these machines is as follows: One row of forgings is set up in either the front or rear fixture, as the case may be, and these forgings are brought into the proper relation to the milling cutters, after which the power feed is engaged. Then, while the milling operation is being performed on forgings held in the first fixture, the machine operator busies himself in unloading the milled pieces from the second fixture and setting up fresh forgings ready for the next operation. After the cut has been taken on the parts held in the first fixture, it is necessary to raise the cross-rail, in order that the table may be traversed over to bring the pieces that have just been set up in the second fixture into the milling position. By setting up two sets of fixtures and using them alternately in this way, a substantial improvement in production time is obtained, as compared with results which would be secured if only one set of work-holding fixtures was utilized.

### Capacity of Planer Type Milling Machines for Removing Metal

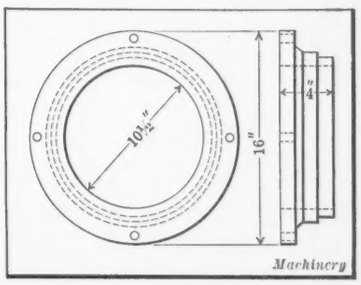
Where heavy forgings and castings require a considerable amount of metal to be removed in order to bring them to the required form, properly designed planer type milling machines are capable of doing such work with great rapidity. This fact is demonstrated by tests made by the Niles-Bement-Pond Co. on machines of this type built at its Bement-Miles Works in Philadelphia, Pa. The following data gives the results of such a test made on a 45-inch connecting-rod milling machine of the three-motor type. The driving motor which was used for making the test developed 90 horsepower, and it was found possible to remove 50 cubic inches of 30-point carbon steel per minute, or 110 cubic inches of cast iron per minute. An inserted-tooth cutter was used for this test which was 18 inches long and provided with high-speed steel blades. Operating with such a motor, it was found that the power supplied to the machine was the limiting factor, rather than any structural limitations of the machine. This size of Bement-Miles connecting-rod milling machine is not ordinarily equipped with so powerful a driving motor. For normal conditions of operation, a 40-horsepower motor is used; and equipped in this way, the machine is capable of removing from 20 to 25 cubic inches of 30-point carbon steel per minute, and 45 to 55 cubic inches of cast iron per minute. In the performance of slabbing operations, that is to say, in taking broad, shallow cuts, the milling cutters are in contact with a much broader area than is the case when performing connecting-rod channeling operations, as a result of which the slabbing cutters work under more favorable conditions for the dissipation of heat. For this reason, more metal can be removed in a given length of time than is true in milling channels in connecting-rods.

With the exception of friction losses, the full power of the driving motor is delivered to the spindle of the Bement-Miles machine, as the feed mechanism is driven from a separate motor which is wired to the driving motor in such a way that when the spindle is stopped the table feed is also automatically disengaged. With such an arrangement, it is obviously impossible to have the table continue feeding when the spindle comes to rest. One important advantage secured by providing a separate feed motor is that the rate of feed is made independent of the spindle speed, thus adapting the machine for milling materials requiring the use of high speed and low feed, or vice versa. This separate feed motor is found very useful when milling rough forgings that are likely to have inequalities in the amount of metal to be removed, thus making it desirable to reduce or increase the rate of feed at different points. The feed motor is of the variable speed type and provides a wide range of feeds with very small changes. This feed motor will adapt itself to a reasonable overload; and it is also used for operating the fast traverse of the table, a switch being provided for that purpose. An important feature in the design of planer milling machines is to provide an elastic medium in the feed mechanism in order to protect the cutters and machine in case an unusual strain is caused by a hard spot in the work.

* * *

## EXPANDING A DIE THAT SHRUNK IN HARDENING

In the completion of the die shown in the accompanying illustration, an interesting method was used which was devised by A. Lindberg, foreman of the hardening room of the Krasberg Engineering & Mfg. Corporation, Chicago, Ill. In turning the lower end of the die previous to hardening, 0.025 inch was left for grinding. In hardening, however, the diameter of the die at this point shrunk 0.035 inch, leaving it 0.010 inch smaller than the required size. The problem was to expand the die so that it could be finished to the correct diameter. This was accomplished in the following manner: The die was heated to a temperature of 1400 degrees F. expanding the hole, which was 10 1/2 inches in diameter when the die was cold, sufficiently to allow a disk 10 9/16 inches in diameter to be slipped into it. The disk was slipped into the hole cold, and then the disk and the die were again heated and allowed to cool together, after which the disk was pushed out of the die. It was found that when the die had cooled, it had been expanded in this manner 0.085 inch, which provided enough stock so that it could be reheated for hardening and quenched, causing a contraction of 0.035 inch but still leaving plenty of stock for grinding to size.




Principal Dimensions of Die that shrunk in hardening

* * *

A fragment of one of the shells used in the long-range gun, with which the Germans attempted to bombard Paris, has provided a source for much interesting investigation. The outstanding feature of the fragment is the fibering of the steel due to chemical constituents and special heat-treating operations. Fibering is desirable where great strength is demanded, but its value is found more especially in cases where resistance to shock is required. The steel is accorded a heat-treatment similar in all respects to that generally given chrome-nickel steel except that, to obtain fibering, the steel is quenched from the drawing temperature. An unusually high percentage of phosphorus in chrome-nickel steel is one chemical constituent which aids in the fibering. This process is of value for axles and other automobile parts.

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## COUNTERACTING UNSOUND ECONOMIC DOCTRINES

The unsound economic doctrines at present being preached to the rank and file of the men engaged in industrial work—particularly the doctrine of inefficiency—must be counteracted by an educational movement inaugurated mainly by employers. It is their imperative duty to institute a campaign of education and information to combat the utterly false and erroneous doctrines now being spread by agitators who serve their own interests only.

The gospel of inefficiency which is being taught to working men will react most unfavorably upon themselves. If they give less and less return for higher wages, the cost of living will inevitably rise and the great mass of the workers will ultimately suffer. Shorter hours must be accompanied by greater efficiency if permanent benefit is to result therefrom. The workers should be enabled to understand that after all it is increased production of commodities which in the long run really benefits them, for if more commodities are not produced when wages are increased, prices will keep pace with the rise in wages, and the wage earner will be no better off, no matter how much his pay is increased. It is how much his dollars will *buy* that is of first importance to him.

Talks and lectures that will clearly show the relation of production to wages will do a great deal to counteract the dangerous influences working for inefficiency. Among the many movements tending to insure industrial good-will and peace none is more important than that the workers thoroughly understand that inefficiency reacts upon themselves by increasing the cost of living.

* * *

## THE BONUS SYSTEM IN THE TOOL-ROOM

While the premium and bonus systems of wage payment have proved of great advantage both to employer and employe when applied to quantity production under regular manufacturing conditions, this principle of determining a fair wage has not generally proved successful for tool-room work. The reason is obvious. In the tool-room the work is of a varied character and the same operations are seldom performed twice in succession. It is, therefore, difficult to make accurate time studies and to determine a fair "bonus time"—that is, the time in which a given job should be completed. For example, it is almost impossible to estimate accurately the time in which a complicated die can be made. For work of this kind, most manufacturers agree that a straight hourly rate is the best method of paying for labor. Another objection to the premium plan for tool work is that on work of this kind the incentive to hurry, which the premium plan offers, may prove expensive in the end, because intricate tool work must be slowly and carefully made and a single mistake in the finishing of a complicated die, for example, may spoil a piece on which already a hundred dollars or more may have been expended in labor and materials.

Another objection to the bonus system in the tool-room is that the toolmaker usually has to perform his work on a number of different machines, moving from one to another until the work is completed; and unless the tool-room is over-equipped—that is, provided with so many machines that some of them stand idle part of the time—there will be occasions when two toolmakers need to use the same machine at the same time, and one has to wait until the other has finished his work on that particular machine. If a time is set within which the toolmaker must finish his work, it is evident that such shop conditions cause friction and dissatisfaction, because, if a bonus time is set, the toolmaker has, of course, a right to expect adequate facilities, so that he can work without interruption. It may be argued that under these conditions the tool-room should be properly equipped with all the machinery necessary; but it may be cheaper to have a man waiting occasionally for another at the machine than to install a new machine which would stand idle a large part of the time.

In very large plants where the tool-room is of such a size as to resemble a small factory, the conditions are different. Then the tool-room work resembles manufacturing work in its uniformity, the same operations are likely to be performed again and again, and it is practicable to make the necessary time studies for setting bonus times and rates which may prove satisfactory all around. In most manufacturing plants, however, the tool-room is small, the work special, and conditions unfavorable to a bonus system.

* * *

## THE SHOP REPRESENTATION IDEA

A new movement of great promise has been inaugurated during the past few years, to which the war and the problems of the reconstruction period have given an added impetus. This is the shop representation plan, giving employes a voice in the management, by having men of their own choosing aid in settling questions which directly concern the personal comfort and welfare of the workers. Men who have made a thorough study of the results obtained in plants where this method has been applied say that it has been remarkably successful and that in no case has it been abandoned because of unsatisfactory results. The most comprehensive shop representation so far developed is based upon the principles of the Government of the United States, and has been adopted by some twenty large industrial concerns in this country. The president of the firm is the president of the managing organization; the officers of the firm are the Cabinet; the superintendents, foremen, and other shop or engineering executives form the Senate; while men elected by the operators in the shop form the House of Representatives. These representatives deal with such questions only as concern the welfare of the employes directly. They have no part in the management of the concern as far as its general outside policies are concerned. It is claimed that the plan has obviated industrial friction, increased efficiency, and effected a better understanding of the mutual interests of employer and employes.

# Machine Tool Prices During Last Five Years

IN connection with the work done by the War Industries Readjustment Committee of the American Society of Mechanical Engineers in cooperation with the Machine Tool Section of the Office of the Director of Sales of the War Department, the editor of MACHINERY had occasion to make an investigation relating to the fluctuations in machine tool prices during the period 1914 to 1919. A summary of this investigation will doubtless prove of great interest to the whole machine tool trade. Different classes of machine tools are dealt with under separate headings, and the average fluctuations in prices, as obtained principally from the manufacturers directly, are given. The average prices in 1914, as far as they could be definitely ascertained, have been taken as a basis and have been given the index number 100. The prices for succeeding years are given an index number indicating the relative increase as compared with 100 for 1914. Hence, if the index figure for 1916 is 150, it indicates that there was an increase of 50 per cent in the price over the average price in 1914.

In many instances improvements in the design of the machines have been made during the past five years, so that the advance indicated is not always merely an increase in the price of a machine of exactly the same design as that sold in 1914, but often covers the cost of a machine of considerably improved design and increased productive capacity. Factors of this kind, however, could not be taken into account in the comparison, so that the index figures relate simply to machines nominally the same as five years ago.

*Bolt and Nut Machines*—The prices of bolt and nut machines rose gradually until they were, in 1916, 50 per cent higher than in 1914. In 1918 and 1919 prices were practically double those in 1914, the average index figures being as follows: 1914, 100; 1915, 120; 1916, 150; 1917, 180; 1918, 200; 1919, 200.

*Boring and Drilling Machines*—Increases in boring and drilling machines were in some instances greater than in any other class of standard machine tools. The increases varied considerably with different manufacturers, but in all cases the prices appear to have doubled between 1914 and 1918. Some manufacturers reduced the prices in 1919, while others are still maintaining the 1918 price. The index figures indicating the greatest rise in this class of machines are as follows: 1915, 135; 1916, 165; 1917, 200; 1918, 257; 1919, 257. The figures indicating the lowest increase are as follows: 1915, 110; 1916, 150; 1917, 180; 1918, 195; 1919, 170.

*Boring and Turning Mills*—In this class of machines the increase was also quite marked, the average index figures being as follows: 1915, 120; 1916, 150; 1917, 190; 1918, 225; 1919, 225.

*Drilling Machines*—In drilling machines, the variations in the increase are more marked than in many other classes of machine tools, due to the fact that there are so many different types of drilling machines, and the figures given can express averages only. For upright drilling machines the following index figures appear to be about right: 1915, 120; 1916, 180; 1917, 200; 1918, 210; 1919, 190. For radial drilling machines the increases were greater: 1915, 120; 1916, 180; 1917, 230; 1918, 250; 1919, 230.

*Forging Machines*—The increase in the price of forging machines was small in the early part of the war, but became very marked after the United States had entered the conflict. The average index figures are as follows: 1915, 110; 1916, 140; 1917, 220; 1918, 225; 1919, 225.

*Gear-cutting Machines*—Owing to the great variation in the classes and types of gear-cutting machines, it is impossible to give a general average. The highest index figures reported are as follows: 1915, 110; 1916, 130; 1917, 180; 1918, 200; 1919, 200. The lowest figures are as follows: 1915, 100; 1916, 130; 1917, 140; 1918, 160; 1919, 160.

*Grinding Machines*—The prices of grinding machines did not advance in the same proportion as many other lines of machine tools, the index figures being: 1915, 100-105; 1916, 120-125; 1917, 150-180; 1918, 170-180; 1919, 160-180.

*Lathes*—The prices of engine lathes more than doubled between 1914 and 1918. The index figures varied with different manufacturers as follows: 1915, 110-135; 1916, 145-165; 1917, 185-220; 1918, 220-230; 1919, 200.

*Milling Machines*—The prices of milling machines did not advance quite as much as some of the other lines. In no case was a report made indicating that the price was quite doubled. The index figures vary as follows: 1915, 105-110; 1916, 130-135; 1917, 170-195; 1918, 190-195; 1919, 160-190.

*Pipe Cutting Machines*—The advances in pipe cutting machines, like the advances in grinding machines, were rather below the average advances for machine tools in general; in fact, the advances were so small that some makers have increased their prices during the present year, the index figures being as follows: 1915, 100; 1916, 100-110; 1917, 110-135; 1918, 165; 1919, 165-180.

*Planers*—Planers reached a high index figure in 1918, but the 1919 prices have been materially reduced, the index average figures being as follows: 1915, 114-122; 1916, 140-150; 1917, 180-190; 1918, 200-230; 1919, 170-200.

*Presses, Hydraulic*—Owing to the fact that hydraulic presses are made in so many different designs and sizes, the increases in prices varied between wide limits, the average index figures being as follows: 1915, 110-115; 1916, 130-140; 1917, 150; 1918, 180-225; 1919, 150-180.

*Screw Machines and Turret Lathes*—The increases in this class of machinery were moderate, the average index figures being as follows: 1915, 115; 1916, 135; 1917, 150; 1918, 165; 1919, 165.

*Shapers*—During 1918 there was a very marked advance in the price of shapers, so much so that in that year the advance equalled that of boring and drilling machines, the index figures being as follows: 1915, 110; 1916, 125; 1917, 165; 1918, 255; 1919, 215.

*Slotters*—The variation in the price of slotters is indicated by the following range of index figures: 1915, 110-125; 1916, 120-150; 1917, 200-210; 1918, 235-290; 1919, 225-260.

*Cold Saw Cutting-off Machines*—The prices of these machines advanced moderately as indicated by the following index figures which are the highest of the reports obtained: 1915, 120; 1916, 120; 1917, 140; 1918, 175; 1919, 160. Some makers never exceeded the index figure 160, which prevailed with them both in 1918 and 1919.

*Shearing Machines*—The average index figures for these machines are as follows: 1915, 110; 1916, 125; 1917, 140; 1918, 165; 1919, 145-180.

*Steam Hammers*—The index figures for steam hammers are: 1915, 110; 1916, 130; 1917, 150; 1918, 170; 1919, 160.

*Thread Milling Machines*—There was quite a variation in the price of thread milling machines and some makers did not advance their prices anywhere nearly as much as others, as indicated by the index figures: 1915, 120; 1916, 130-150; 1917, 145-175; 1918, 175-200; 1919, 175-195.

The average advance of machine tools from 1914 to 1915, based upon these figures, was about 15 per cent, and the advance in 1916 over the 1914 price averaged about 35 per cent. The advance in 1917 averaged about 70 per cent, and the 1918 advance, about 100 per cent over the price in 1914, while present prices are on an average from 5 to 10 per cent lower than the prices in 1918, it being noted however, that many classes of machine tools have not been reduced at all.

# Securing the Cooperation of Your Employes

By WILLIAM A. ROCKENFIELD

Assistant General Manager, Baldwin Chain & Mfg. Co., Worcester, Mass.

THE first requirement in securing the loyalty and cooperation of employes is for the man at the head of the concern to have the right attitude toward labor, because his attitude will be reflected throughout the organization, and department managers, superintendents, and foremen will deal with the employes under them very much in the same way as would the general executive. His attitude, generally speaking, determines the conditions throughout the plant, not only because the men holding minor executive positions under him will reflect his ideas, but also because he will, in the first place, select the type of men for these positions who are capable of dealing with labor in the same way as he would.

The foremen of the plant should be examples of what the employes working under their direction ought to be. If integrity, good habits, and loyalty are not seen in the foremen, these characteristics cannot be expected in the men. It is therefore of great importance to select foremen who will have not only mechanical and executive ability, but who will also have the proper character and personality.

### How to Build up the Right Kind of Organization

In order to build up the right kind of organization, it is necessary to begin with hiring the right kind of men. The strongest organization is that in which men having initiative and ambition, coupled with loyalty, are represented in the greatest proportion. To achieve real results, it is important that even the minor jobs are filled with men having what is ordinarily termed "backbone." Men of strong character are of value everywhere throughout a plant. There are always occasions when these men will prove more valuable than the vacillating kind, lacking initiative and energy.

After a man is hired, it is well to have a heart-to-heart talk with him, both for his own sake and for the best interests of the firm, telling him just how important the work for which he is hired is and what is expected of him in order to succeed, and making him feel that you depend upon him to make good. He should be told about the general principles upon which the firm is conducted—quantity, quality, and any other of the most important considerations in the success of the business. If this is done, the new employe will feel at home from the start, and will have a sense of responsibility which he otherwise would acquire only after a long period of employment.

### Promotions within the Organization

Much has been said about promoting men within the organization when an opportunity presents itself. Too much cannot be said, however, on this subject. Mistakes are constantly made in the industrial world by bringing in outsiders, thereby creating jealousy and dissatisfaction and preventing harmony and cooperation.

When promoting a man within the organization to a position of responsibility, it is well to have a talk with the man promoted, making clear to him exactly what is expected of him in his new job, letting him know that his efforts in the past have been closely watched, and that on the strength of the observations made, he has been selected for the new position. Tell him what the difficulties are that he may meet with and how they can best be overcome. If he has been selected in place of some other man who, by length of service or for some other reason, might have been thought to be the logical man for the place, tell him frankly why he was selected instead, so that he may understand what qualities of his are appreciated, and may have an incentive to further develop these qualities. If a man has been obviously passed by in the scheme of promotions, it is politic also to have a talk with the man who thinks that he is slighted, instead of letting him develop a grudge. Tell him frankly why he has not been promoted, giving him an opportunity to understand that he either lacks certain qualifications or is not properly improving his opportunities. If such a talk is held in a friendly and encouraging manner, this may aid the man in conquering his shortcomings and later he may be in line for promotion.

It is of importance to give a promoted man the impression that you have complete confidence in him and that you believe that he can perform the work for which he has been selected; otherwise, he will undertake the job halfheartedly and will not be likely to show himself to the best advantage. When a man knows that you believe in his ability and that you expect him to make good, he is likely to develop qualifications that no one previously thought he possessed. Many a man has discovered himself simply through the confidence placed in him by others.

### Objections of Men to New Ideas

The human race, as a whole, objects to changes, and new ideas are not received in a machine shop any more readily than they are in any other place. As a general rule, therefore, it may be accepted as an axiom that the men will be suspicious of new ideas; hence, changes should be introduced in a careful and diplomatic manner. The men affected should be told the reasons why the change is proposed, and an effort should be made to educate them to see why the new idea is of advantage, before it has actually been put in force. Especially make it clear to the men that the innovations will not be detrimental to their interests, and show them how it will be of benefit either by increasing their earnings or lightening their work. It is unreasonable to expect that the men in the shop would receive an innovation kindly if they had any reason to believe that the new departure would be detrimental to them, financially or otherwise.

### Mutual Understanding, the Secret of Success in Dealing with Men

The foundation for successful dealing with men is mutual understanding. A frank and truthful explanation in the case of any misunderstandings that arise will do more to create good feeling between employer and employe than an endless variety of welfare work. The manager who cannot put himself in the place of the shop man is unable to get the best results from his men. Too much secrecy as to the aims and purposes of the concern tends to breed suspicion among the men and leads them to believe that the profits of the firm are exorbitant and that they therefore are underpaid. The average shop man in the machine tool trade is intelligent, even though he may not be well educated; if explained in a clear, direct and simple manner, he will understand most of the problems that are involved in the management of a shop. Such explanations should be given from time to time in talks between the manager and some of the men who may be considered leaders in the shop. They will then communicate the information obtained to their friends.

One thing that is of importance is to explain to the men that their wages constitute but a small part of the total expenses of the shop, and that the selling price of the product includes a great many items besides the wages of the men

who perform the machining or assemble the device being made. The writer himself, when he worked in a shop, considered the piece rate that he received for a certain part far too low, because he received only 30 cents per hour for the machining on a tool that afterward was sold for $4. Later he learned that, besides the machining, there was the raw material, the forging, the toolmaking, the assembling, and the storing and shipping to be paid for, in addition to the selling expense, the rent of the factory, the insurance, taxes, and the hundred and one minor items that enter into the cost of production.

It is believed, in general, that a great deal of misunderstanding could be avoided if the owners and managers of the industries would take the men into their confidence, and have talks delivered at regular intervals in which a speaker would explain to the men in simple terms the problems concerning the industry, and frankly elaborate upon the conditions involved. Most of our industrial unrest and difficulties are due to secrecy on the part of employers who hold that these matters do not concern the employes. Perhaps they do not, but if better feeling and closer cooperation can be created by educating the men along these lines in order to make them understand and take an interest in the bigger problems of production, a great deal has been gained.

### The Handling of Foreign Labor

A great mistake has probably been made in many American industries by keeping men of the same nationality or race together in one department. When this is done, it often happens that some fancied grievance takes undue proportions, because the men get together and talk about this grievance in their own language until it grows to a great injustice in their minds. The grievance may look bigger to them, too, because of some national characteristic that they possess. They will all have the same viewpoint, and when once convinced that they have a grievance, it will be difficult to persuade them to the contrary.

The best plan is to have men of different nationalities work together in the same departments, as there will then be no collective discontent. Every nationality has its own characteristics, and when a discussion comes up, there will be many different viewpoints brought to bear upon the question. The manufacturer should particularly see that there is enough of a sprinkling of native Americans, or at least of American citizens, in every department so that the general spirit of the department will be American.

Furthermore, the mixing of different nationalities makes it possible for each nationality to appreciate the virtues of the other. There is also likely to be a friendly rivalry between men of different nationality, and, in addition, if there is a sprinkling of Americans among them, the others will automatically become Americanized.

Last, but not least, it should be impressed upon every manager that all foreign-born labor will appreciate humane treatment, and if he deals with the southern European with the same tact and consideration as he does with the native American, he will soon find that the foreign worker will respond to this treatment in the most unexpected manner. Frankly speaking, many of the southern European laborers have hardly been treated as human beings. They have been expected to come to work at a certain hour and to leave the shop at another hour and to perform a certain kind of work meanwhile. As a rule, no one realizes that these men have exactly the same thoughts, aspirations, and ideals as those born here. Much of the misunderstanding, of course, is due to the fact that these men seldom understand English well, and are unable to express themselves clearly. One of the greatest services at the present time that the manager of a plant can render, both to these men and to the industry itself, is to encourage the southern European to learn to speak English, and in case he is illiterate, to learn to read and write English. Most cities now provide evening schools for this purpose, and by proper encouragement it is likely that satisfactory results can be obtained.

### Recruiting the Working Force by Recommendations of Other Employes

It has been found to be a good plan to obtain a new man by the recommendation of men already in the employ of a company, who have proved to possess the proper qualifications. A good workman is not likely to recommend somebody who would prove unsatisfactory, because he would feel that he would hurt his own reputation by so doing. A man of good habits is not likely to recommend one who is very different from himself. It is of considerable advantage to place relatives and friends of satisfactory men in the shop, but they should not be placed under the authority of a relative or friend, nor should they be so placed that they are working together. It is better to have them distributed throughout the shop, so that, if they have good characteristics, their influence will spread throughout the remainder of the working force.

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## INCREASED EFFICIENCY TAUGHT BY THE WAR

The war has undoubtedly taught an important lesson in regard to the increasing of efficiency in machine building plants. There are numerous cases on record where today manufacturers are turning out a much larger product than five years ago with the same force and equipment. The production per man and machine has been increased by stopping many small leaks. In one instance on record, more machines are being built by a force 75 per cent of the normal than were formerly built by the full force. In another instance, the production is being maintained by a force two-thirds that of five years ago. Another case may be mentioned where the production has been doubled without materially increasing either the force or the equipment. It is evident that such economies and increased efficiency are necessary in order to cope with the increasing wages, taxes, and costs generally.

The advantages of salvaging small tools such as milling cutters and reamers seem, however, to have been forgotten with the advent of peace. The shops in the Detroit district that devoted themselves to this class of work report that the reclaiming business is quite dull and that at the present time only new tools are wanted and no one is paying any attention to the saving made possible by salvaging. Some manufacturers who devoted themselves to the salvaging of reamers and milling cutters, therefore, have gone into the regular cutter and reamer manufacturing business. Whether there is not a definite economic loss to the nation as a whole in the dropping of the salvaging business is difficult to decide, because it is evident that with the reduction in the prices of high-speed steel the saving by salvaging becomes less, but it is nevertheless likely that a substantial saving could be effected if users of tools utilized the salvaging processes. A comparison between the conditions at this time and during the war in regard to the salvaging of tools would prove interesting.

* * *

## EXPORTS OF METAL-WORKING MACHINERY

The Department of Commerce has just made public a tabulated statement relating to the exports of metal-working machinery from the United States during the month of May. From this statement it appears that the total value of all metal-working machinery exported from the United States during the month was $2,559,084, of which more than one third, or $943,324 worth went to France; machinery to a value of $356,031 went to Japan, which was our next largest customer; and $304,356 worth went to England, which ranked third. The fourth place is taken by Italy, the fifth by Belgium, and the sixth by Canada. Of the total exports of metal-working machinery, about $1,700,000 represents the value of machine tools, the value of lathes alone being equal to $513,067 which indicates that in spite of the fact that the production of lathes was so large during the war period, there is still a large export trade in this type of machine tools. England alone imported $131,139 worth in May.

Fig. 1. The Roof Garden of the Globe Machine & Stamping Co.'s Social Club overlooking Lake Erie

# Making the Factory a Place of Both Work and Play

ANYONE who has followed the trend in the industries during the past year cannot have failed to notice the tendency toward creating a better understanding between employer and employe by an increased interest on the part of the employer in the welfare and happiness of the men and women working in his plant. It has become evident to thoughtful men that many of the evil influences of our times, due to extreme agitation and radicalism, must be counteracted by sane policies and the promotion of a better understanding between the men who manage industrial undertakings and those who perform the actual productive labor.

A great many means have been devised for the promotion of a better understanding in the industries and each one has met with a measure of success according to the personal qualifications of the men who have devised and managed the work thus undertaken. An original and unusually attractive departure has been made by the Globe Machine & Stamping Co., Cleveland, Ohio, under the guidance of the company's general manager, Albert F. Schroeder. The underlying idea of the Globe Machine & Stamping Co.'s efforts in promoting good will and loyalty is that better acquaintance between employer and employe, manager and workman, office force and operators in the shop would undoubtedly create a more harmonious feeling, and greater cooperation and loyalty among the whole working force. From this fundamental idea sprung the conception of the Globe Social Club which occupies the entire fourth floor of the company's new factory building. This club, as indicated by the accompanying illustrations, possesses as attractive features as some of the

Fig. 2. The Open Fireplace and its Home-like Setting, giving an Opportunity for Rest and Recreation after the Day's Work

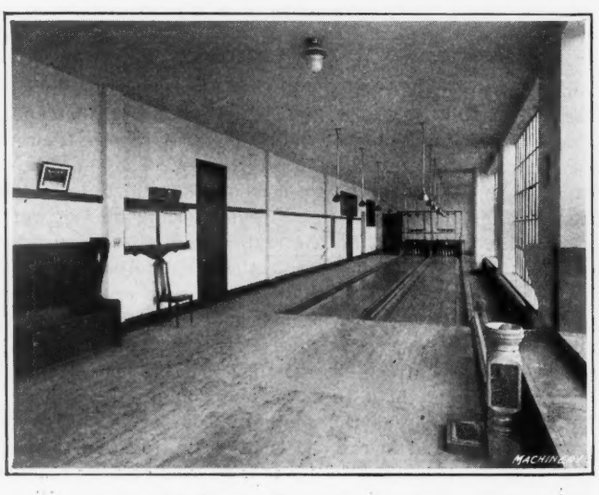

Fig. 3. The Bowling Alleys, an Important Feature in Connection with the Globe Machine & Stamping Co.'s Social Club

best business men's clubs. It is a club to which all the employes of the company may belong after they have been in the company's service for thirty days. A nominal membership fee of 50 cents a month is charged, and the officers and the board of directors of the club are elected by the individual vote of all the employes.

The club is open every evening until 10:30; Saturdays it is open from noon until the same hour at night, and Sundays it is open all day long. The employes of the company may bring their wives and children, sweethearts or friends, and every facility is provided to make the club a pleasant place for passing the leisure hours. The officials of the company at this club meet the men working in the shop, become acquainted with them, and in that way both sides gain an understanding of each other that they could not otherwise obtain. The employes themselves will also become better acquainted with one another, and as acquaintance generally eliminates a great deal of friction and misunderstanding, the advantage gained in this way alone is of the greatest value.

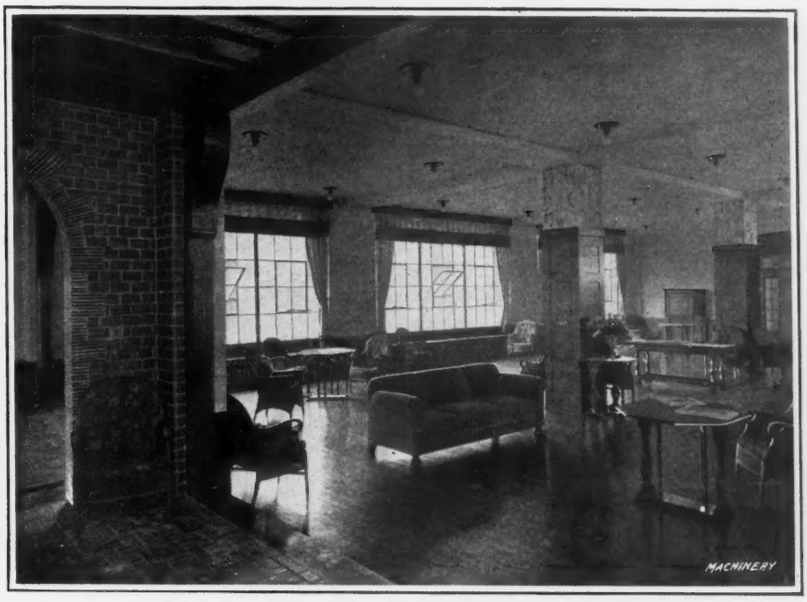


Fig. 4. General View of the Main Club-room or Lounge

Mr. Schroeder believes that in any industrial organization where it is generally understood that every man from the general manager down, is a fellow-employe working for the interests of the company, there is likely to be more cooperation than would otherwise be possible. While each man has his place, one as manager, one as foreman, one as operator, they all are necessary to the ultimate success of the undertaking, and by promoting friendly acquaintance among all, the efficiency of the plant is greatly increased.

When the management of a plant clearly shows that its interest in the employes continues beyond the eight or nine hours a day that the man is at work, a better understanding is certain to follow, and by making the factory itself a place for recreation as well as for work, the men become more closely tied to their place of employment.

The purpose of maintaining the Globe Social Club is to create and hold an efficient working force of loyal men having high standards, who are tied together by a common purpose and common ideas. It is quite evident that the results expected will be obtained. The club-rooms have been well frequented every evening, Saturday afternoon, and Sunday. Many of the men have brought friends to the club, and these, being impressed by the conditions surrounding the plant, later have found employment with the company. All guests brought to the club are registered the same as in any ordinary club, and out-of-town visitors to the firm may be given club privilege cards.

In conclusion, it may be stated that the principle embodied in the club idea is to provide that means for bringing about a friendly understanding among all those working for the best interests of the company without which the most efficient results cannot be obtained. The idea is full of possibilities and should be capable of various applications. E. O.

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## INDUSTRIAL CONDITIONS IN FRANCE

Upon his return from France early in July, Samuel S. Buckley, president of the Onondaga Steel Co., Inc., Syracuse, N. Y., stated that there was decided unrest among labor throughout France. Most of the workers have been in the government service for the past five years, and it is very difficult for them to adjust themselves to peace-time conditions. They show no eagerness to return to industrial life.

If coal can be secured, the steel industry of France will recover quite rapidly and much more quickly than the coal industry, as most of the coal mines have been destroyed. Furthermore, the steel plants are more or less scattered, and did not suffer to the same extent as the ore and coal mines. In the Lens district it is expected that it will be fully three years before conditions will approach normal, as far as coal mining is concerned.

According to Mr. Buckley, there is little to fear from French competition in the American market. Likewise it does not seem probable that America will make great inroads into the French tool steel market. For a long time to come, or until France again returns to normal industrial conditions, England and Sweden will supply most of the French tool steel imports. Wages in the French steel mills are very high at present and compare favorably with those paid in the United States.

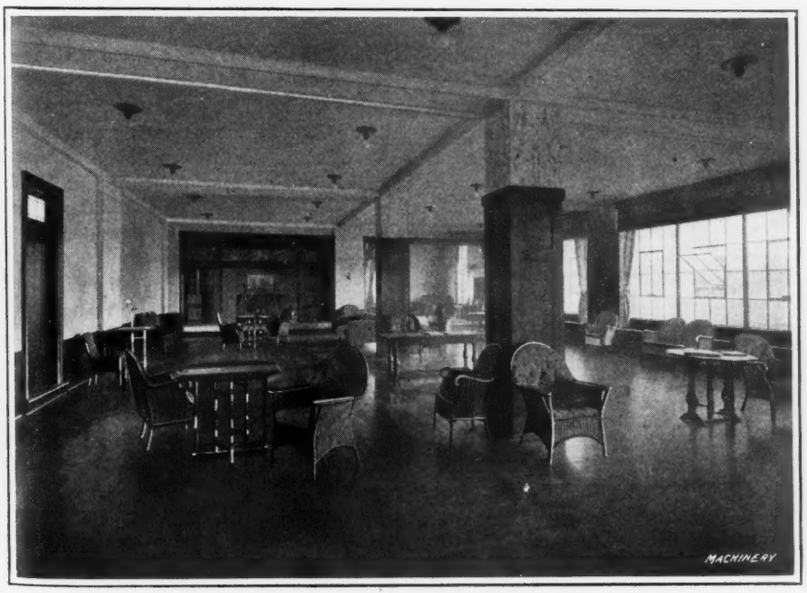



Fig. 5. Another View in the Lounge

# Conditions in the Machine Tool Trade

THE general indications in the machine tool trade point to a gradual but decided improvement. The greatest improvements in the trade are found in the middle-western states that are affected by the great activities in the automobile trade in Detroit. Many automobile builders are increasing their production, and the deliveries of most of the well-known cars are behind. Some makers, unable to meet the demands of the domestic trade fully, refuse export orders. The Ford Motor Co. is said to be making 3200 cars per day, in addition to repair parts, which in some instances run up to many thousand sets a day on account of the fact that there are now about 3,000,000 Ford automobiles in use in the United States. Even with this production, the company was said to be 125,000 cars behind in deliveries in the early part of July.

The General Motors Corporation is building a number of plants in Detroit and in adjacent towns, and many of the other automobile builders are preparing for increased production. This has had a marked effect on the small tool industry in Detroit and vicinity, and on the machine tool industry in general. Machine tool dealers in Detroit report that the demand for machine tools is good and that the sale of second-hand tools has not materially affected the sale of new machines. The recent sales of new government machines, however, doubtless have affected the market slightly as far as the machine tool builder is concerned, but the machine tool dealer has not suffered from this, because, as a rule, the machines have first been sold to dealers and have then been resold by them to the actual users, the dealer being in a better position to absorb a varied assortment of machine tools than the user would be, and the dealer, therefore, seems to be the logical distributor of the government machines.

The improvement in the machine tool trade is by no means confined to the Middle West. Reports from New England indicate increased activity in that part of the country, and some of the leading manufacturers both in New England and in the Middle West now quote on 1920 deliveries. Many machine tool builders state that their shops are now as busy as during the corresponding period last year, and complaints that it is impossible to obtain the necessary number of skilled operators are frequently heard. In fact, some state that even more business could be obtained than is actually booked, if it were possible to quote on earlier deliveries.

### Prices of Machine Tools

The price situation now appears to have become stabilized. No reductions in prices have been made for the past two months and some manufacturers report that they may find it necessary to increase their prices slightly in the near future. In the wood-working machinery line, prices are being raised at the present time, this being made necessary by the conditions in the labor market. In the Detroit district, for example, wages are now higher than during the war. In spite of this, some manufacturers report that they have more men and do more business than a year ago. A review of the fluctuations in machine tool prices during the last five years is given on page 1127 of this number of MACHINERY.

### The Export Trade

The export business leaves a great deal to be desired. The Belgian exports seem to move freely, and some manufacturers report that they are able to export to France without difficulty; but others have found it difficult for their representatives in France to obtain the required import licenses. It is a curious fact that lathes are being regularly exported to France although it was the general opinion immediately after the armistice that there was a surplus of lathes in Europe. Lathes are also being exported to England in fairly large quantities.

Some manufacturers state that the lack of shipping facilities to South America and Australia adversely affects their trade with those countries. Some manufacturers who had a regular, even if small, trade with those parts of the world find themselves cut off from this market because of the difficulty in obtaining shipping space. It is believed that after the ratification of the peace treaty and the diversion of a large percentage of the world's tonnage from war to peace purposes, this difficulty will be removed.

### The Question of Credit to Foreign Dealers

Some European machine tool dealers complain that American manufacturers will not extend credit, but require cash payment against bill of lading in New York. They claim that this hampers the foreign trade and makes it impossible for the dealers to put in the necessary stock of American machine tools. It has been stated repeatedly that it would be necessary for American manufacturers to extend credits in Europe if our foreign trade was to develop to anything like what it should be. It is also stated that British machine tool builders extend long credits to these dealers and that in this way the importation into various European countries of British machine tools is aided while the importation of American machine tools is restricted. Some means ought to be found for remedying this condition if it is general. The dealers who state that they find difficulties in buying on account of the restricted credit arrangements appear to have a good financial standing, and, therefore, the policy of refusing credit does not seem to be one of ordinary business caution, but rather a relic from the past business policy of American manufacturers, which has been to give much less favorable terms as regards credits than their European competitors. At any rate, the matter is one that might well be looked into, and if the manufacturers cannot individually arrange for extended credits, the banking institutions ought to become active and thereby further the American export trade.

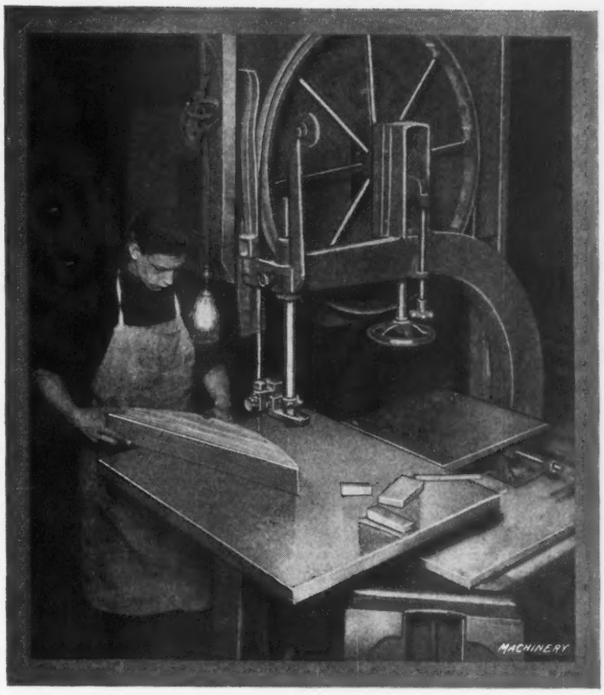
### The Labor Situation

There is a scarcity of skilled labor in the machine tool industries in most parts of the country. In some instances, wages are higher at this time than during the war period. There is no unemployment among skilled mechanics; if there is any unemployment, it is wholly among men who are not able to do a day's work commensurate with the present wages being paid. Skilled men have no difficulty in obtaining either employment or satisfactory wages, but manufacturers claim that unskilled men demand wages that are out of all proportion to their training or ability and that they are not willing to serve a sufficient training period at lower wages to enable them to demand higher wages later as a result of the skill and training thus obtained. Some machine tool builders are unable to increase their production and accelerate their deliveries to the point that otherwise would be possible because of the shortage of good mechanics. This condition is not local, but is found all the way from New England to the middle western states. Where machine tool builders had been obliged to reduce their force on account of the temporary dullness following the armistice, the men laid off have generally been those who were hired during the war period as an emergency, and who did not have the required training to meet the normal peace conditions at the present high standard of wages.

# Gear Patterns

## Methods of Laying Out and Constructing Patterns for Spur and Bevel Gears and Worm-wheels

By JOSEPH A. SHELLY




GEAR patterns may have either completely finished teeth or they may have an allowance or "finish" added to the teeth for finishing in a gear-cutter. If the pattern is for a cast or uncut gear and a smooth-running gear is desired, the teeth should be accurately laid out and worked to form. Small gear patterns are usually made in one piece with the teeth cut from the solid block or blank after it has been turned up, but the larger wheels are made with pieces called "tooth-blocks" fastened to the rim in such a manner that they may be removed for working to form before fastening permanently in place, or the teeth may be finished by jigging or sanding and then fastened to the wheel rim.

### Fastening Tooth-blocks to Blanks

The rims of large gears are usually built of segments the same as flywheels or pulleys, and the blocks for the teeth are fitted and fastened to the rim for turning to diameter, the ends of the blocks being flush with the edge of the rim. The simplest way to fasten the blocks is to glue and nail them into place, as at *A*, Fig. 1. This is frequently done, but is objectionable because the block cannot be removed for working it to shape. To overcome this objection, the methods illustrated at *B* and *C* are generally employed. The old dovetailed method shown at *B* permits replacing the tooth-blocks, but is expensive and is now almost obsolete.

The excellent method shown at *C* is much less costly than dovetailing. The rim in this case is turned from 3/8 to 1/2 inch under size and this difference is made up by cutting part of the rim from the tooth-blocks. Every other block is glued and nailed to the rim while the intervening block is not glued, but fastened by a screw entering each end from the inside of the rim. This permits every other tooth to be removed for working and leaves room to form the glued tooth while it is in place on the rim. Another scheme for fastening blocks to blanks for heavy wide-faced gears is to use two dowel-pins and two screws through the point of each tooth. When teeth are made by the use of jigs, as described later, they are finished completely before being attached to the rim, except that wax or leather fillets are added afterward. Teeth formed by jigs are illustrated at *D*. Jigged or sanded teeth are fastened to the rim with glue and nails and are not turned.

### Laying out Spur Gear Tooth-blocks

In turning a solid blank or the tooth-blocks after they are fastened in place, it is necessary to lay off the pitch and base circles on both sides. This should be done with sharp-pointed trammels or dividers while the blank or wheel is revolved at a slow speed in the lathe; the blank will require rechucking in order to get the lines on both sides. With a bevel gear the lines are laid out on the large and small ends of the teeth. The amount of draft to allow on spur gear teeth should be small, not exceeding 1/64 inch in 6 inches, and on teeth of 2 inches or less in face width, the draft should be very slight in the direction of the draw.

The first thing to do is to space off the tooth centers and draw the radial center lines of the teeth. A pair of spring dividers should be used for the spacing and for drawing the tooth curves, as they permit of finer adjustment than the winged type. It is a good plan to draw the pitch circle on a lay-out board and do the preliminary spacing on it until the dividers are properly set, when they may be tested by spacing off on the pitch circle on the gear. This trial spacing should not start in the center of a tooth-block until the pitch circle has been divided once to verify the divider setting. If this is found correct, the centers may be spaced off and the radial center lines drawn through the center of each block with a sharp knife. One of these center lines must be accurately squared across the point of a block to transfer the center line to the opposite side for spacing that side with the dividers. The radial centers may be drawn with a straightedge, but a quicker way is to use the center square. The width of the teeth is next laid out by spacing half the width of a tooth each side of the radial center on the pitch circle, making this width slightly less on the drag side to provide draft. Curves to form the face, the flank, and the fillet at the root of the teeth should then be laid out. Instead of laying out each tooth separately, a templet of wood or sheet metal is more often used, as shown at *E*, Fig. 1. It should be accurately made and have a sharp center line and a hole corresponding with a similar hole in the blank or gear center for a pin on which it can revolve. There are two kinds of gear teeth used in cast gears—cycloidal and involute; they differ in the manner in which the tooth curves are generated, the cycloidal tooth having two curves and the involute one, for forming the face and flanks of the teeth. The proportioning of tooth parts and the laying out of the flank and face curves is simplified by the use of Grant's odontograph (see MACHINERY'S HANDBOOK, page 582). An allowance for backlash on the teeth will have to be made to compensate for inaccuracies in the casting.

### Laying out Bevel Gears

In laying out a bevel gear, a half section on one side of the axial center (see Fig. 2) is required. The toοth centers should be laid off while the rim is still fastened to the lathe faceplate. A central column to form the apex of the cone is fastened to the faceplate, thus providing a center for drawing the radial center lines (see sketch *A*, Fig. 3). The spacing for tooth centers should be on a circle that falls slightly inside the outer edge of the rim. If tooth-blocks are to be used, the same methods may be employed as for spur gears. The centers are laid out on the blocks after they have been turned. If the teeth are to be finished before applying them to the rim, the centers are scribed on the rim and the edge of each tooth, instead of the center, is set to the line. The teeth should not be nailed to the rim until the glue has set.

The pitch circle, base circle, and circle representing the points of the teeth on the large end are scribed with *E*, Fig. 2, as a center, and lines are drawn from the large end of the tooth to the apex of the cone. The radii of the circles for the small end of the tooth may then be obtained from the lay-out by measuring from center *F*. Corresponding arcs are then drawn from center *E* for laying off the tooth profiles. The thickness of the tooth at the large end is next laid off and the face curve drawn; the flank is a straight line. With the apex of the cone as a center, the width of the tooth is projected with a pair of dividers, and a plan is drawn, after which the thickness and the face curve centers on the large end are laid off. Lines from these center points are then drawn to the apex of the cone, giving the width and curve centers at the small end which may be laid out on the arcs previously scribed from *E*. If the teeth are to be "jigged," as explained later, the ends of the jig blocks are laid out as shown by the shaded sections. Arcs are also struck from *E*, and the end forms for the jig laid out as though it were a wide tooth.

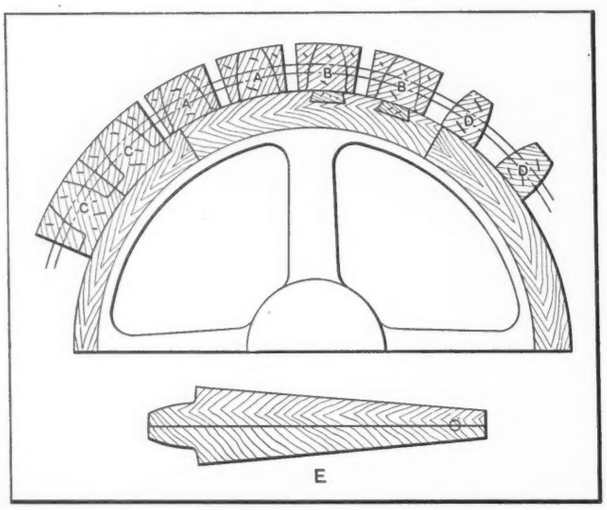



Fig. 1. Different Methods of fastening Gear Tooth-blocks to Pattern Rim

### Band-sawing Gear Teeth

Gear teeth may be cut to form on the band saw by fastening the tooth-block to a jig which holds it in the proper position, and if the saw is in good condition very little finishing will be required. The faces and flanks on small spur gears are best finished in this way and require laying out only on one side; but the root circle and fillets will probably have to be cut with a chisel and gouge unless a very narrow and sharp saw is available. Bevel gear teeth may be bandsawed by means of the jig shown at *B*, Fig. 3. A socket *a* is turned in the small side of the blank to fit the spherical-ended post *b* which is fastened to a board clamped to the saw table. The band saw *c* runs through the center of the sphere. This jig should be so designed that all lines on the tooth will intersect with the center; an entire sphere will not be required in most cases, and it will only be necessary to lay out the teeth on the large end.

### Planing Gear Teeth

Planing gear tooth-blocks by hand requires great skill and care to produce uniform teeth. If the fillets are part of the tooth, a rabbet plane will have to be used and the fillet worked with a gouge after the tooth is glued in place. Removable tooth-blocks should be taken off one at a time and returned to the proper place as soon as they are finished. It is well to mark each tooth for this purpose.

### Jigging Gear Teeth

One of the most economical and practical methods of forming teeth is by jigging. A hard wood jig block *A*, Fig. 4, is used. The tooth-block is fastened to the jig block by screws through the bottom, and the tooth is planed until it is flush with the jig. To overcome the likelihood of taking an occasional slice out of the jig, it may be cut back or relieved as at *B* and the plane so manipulated that the cutting edges start and stop in the clearance spaces at each end. These jigs are clamped endwise in the vise when in use. Another method of using jig *B* is to clamp a long wooden jointer

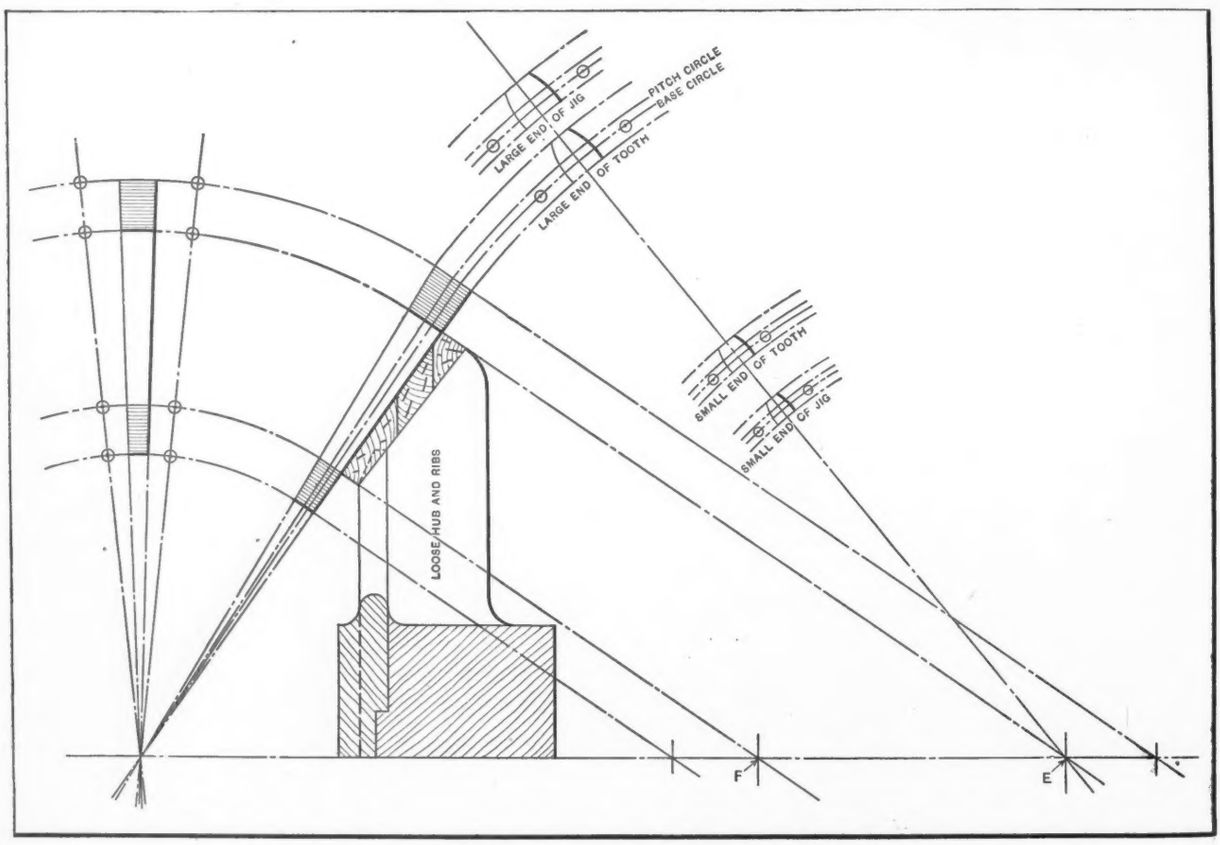



Fig. 2. Diagram illustrating Method of laying out a Bevel Gear Pattern

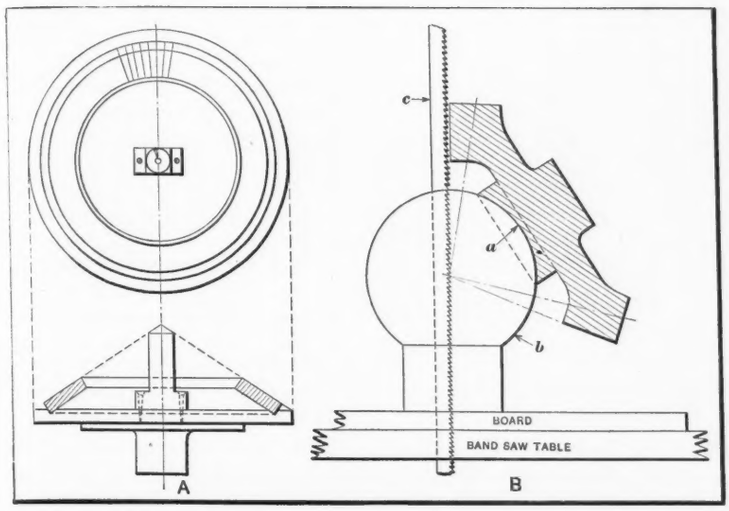



Fig. 3. (A) Bevel Gear Pattern on Faceplate with Central Pin or Column attached to form Apex of Pitch Cone for laying out a Pattern. (B) Forming Teeth of Bevel Gear Pattern on Band Saw

plane in the vise, face upward, and fasten blocks to the upturned face to regulate the starting and stopping of the cut. In this case the jig with the tooth-block in place is drawn over the cutting edge of the plane, the stops fixing the starting and stopping of the cut in the clear space at the ends and eliminating the danger of cutting the jig.

### Sanding Gear Teeth

Another method of finishing gear teeth rapidly is by sanding. A jig is used similar to those already described, except that a flange is added at the end. A jig for sanding a bevel gear tooth is shown at *A*, Fig. 5. The sanding cylinder *B* is turned to a diameter of about 4 inches, and the groove for the sandpaper is made slightly deeper than the paper thickness so that the ends may be finished flush with the sand surface after the paper is glued in place. The paper should not be put on in a wide sheet but cut in a narrow strip and wound spirally around the cylinder, as it is easier to apply and will be smoother when put on in this way. Thumb-tacks may be used to secure the ends while the glue is drying. The groove for the flange on the jig should be a loose fit; its function is to aid in holding the jig parallel to the axis each time it is used. Before starting to sand a

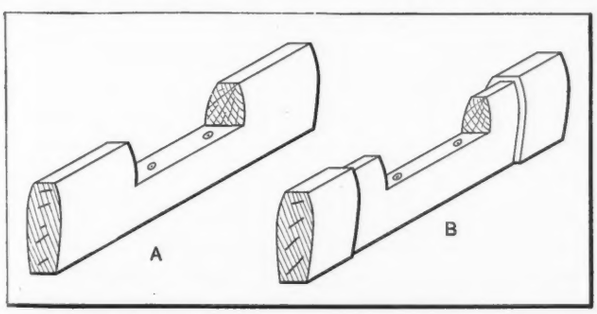



Fig. 4. Jig Blocks which serve as a Guide when forming Gear Teeth

tooth, a straightedge should be sanded to remove any projecting pieces of sand. The tooth-blocks should be roughed out so as to leave as little material as possible to be removed by the sanding.

Teeth made by jigging and sanding do not provide for fillets, and these will have to be made either of wax or of leather. In fastening finished teeth to a wheel, the edge of the tooth should be set to the center which, in the case of a spur gear, should be squared across the face for this purpose. The glue should be applied to each end of the tooth, and the nails should not be driven until the glue has set.

### Worm and Screw Patterns

Patterns for worms and screws are usually parted longitudinally, as illustrated in Fig. 6. The usual practice is to turn up a cylinder to the outside diameter of the worm with the prints attached; the grain should run lengthwise and the centers on the ends of the cylinder should be carefully preserved in order that the finished worm may be sandpapered in the lathe.

To lay out a worm, a piece of manila drawing paper as wide as the worm is long and of a length equal to the circumference, is used to get the pitch angle (helix angle of thread) for laying out the "spiral" or helix. The paper should have straight edges and be square at the corners; it is better to do all the cutting with a sharp knife and a straightedge. On one of the edges representing the length of the worm, the pitch or distance from the center of one thread to the center of the next should be measured; a line is then drawn from this point to the opposite corner (see diagram *A*, Fig. 8) and the paper is cut along this line with a knife. Parallel lines $x$ are next drawn with a distance between them equal to half the circumference. On the joint of the drag half of the pattern, the screw sections and pitch angles are laid out, the lines representing the top of the thread being carried across the joint with sharp knife lines, as at *C*. The paper pattern is then stretched tightly around the half pattern with the same circumference lines $x$ coinciding with the edges of the joint, and the spiral

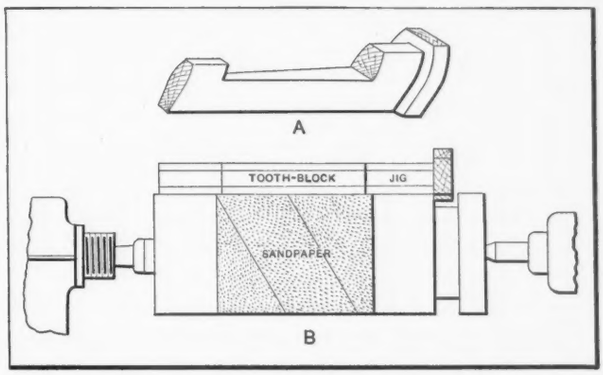



Fig. 5. Forming Gear Teeth with Sanding Cylinder and Jig Block

line connecting the lay-out lines on the joint is drawn around the outside of the half barrel with a sharp pencil which is guided by edge $y$ of the proper templet. When the lines from one end to the center of the worm have been drawn, it will be necessary to start from the other end, as there will not be enough bearing surface on the pattern for the paper templet. When one half is laid off, the pattern is put together and the lines continued around the opposite half in the same manner. Another method is to lay out all the lines on a paper pattern and wrap it around the barrel, fastening the ends with thumb-tacks or glue, and transferring the lines to the barrel by means of a tracing wheel.

### Forming the Pattern Thread

The thread grooves may be roughed out by making cuts with a back-saw provided with a gage to prevent the saw from cutting too deep. Plenty of stock should be left for

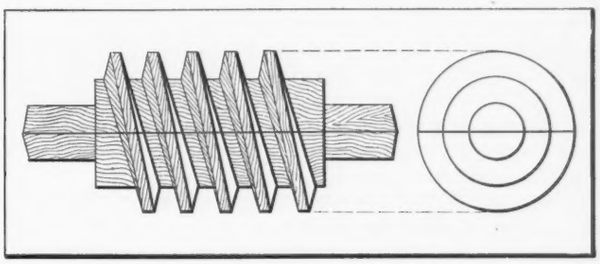


Fig. 6. Worm Pattern

finishing to templet *B*. In using the templet, the face should be held in a radial position. There is another method of roughing and finishing the grooves requiring the use of the circular saw. This involves cutting a shallow groove in the center of the spaces between the teeth for receiving a guiding pin that is placed in a long angle-plate extending completely across the saw table; the saw extends through the block directly below the center of the worm to be cut. The angle-plate is clamped to the saw table at the correct pitch angle and the table is tilted to give the angle of the sides of the teeth (14½ degrees). The worm, which is placed in the angle-plate with the guide in the groove, is slowly revolved while the saw cuts the spiral groove.

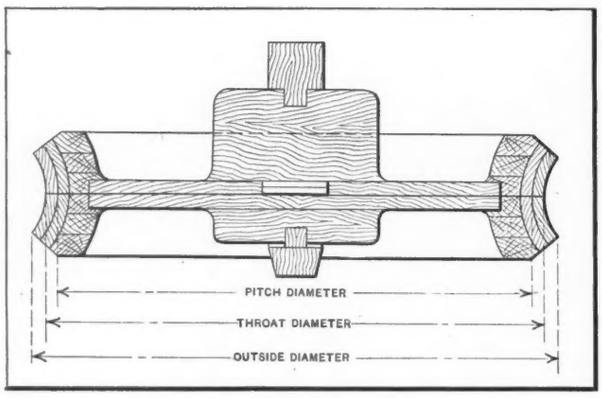



Fig. 7. Pattern for Worm-wheel

### Making Worms and Screws on a Band Saw

Another method of making worms and screws is to turn up the barrel to the root diameter of the thread and make the thread separately. The pattern illustrated in Fig. 6 was made in this way. A half round bushing *A*, Fig. 9, is used to make the teeth. The spirals at the base of the thread grooves are laid out on the inside of the half bushing and cut in a half core-box form of jig fastened to the saw table, as shown at *B*. This jig is fastened to an angle-block that can be reversed to saw the rake on both sides of the teeth, and the piece to be sawn must be manipulated from the rear of the saw table. A more convenient method is to lay out the spirals on the outside of the bushing and cut them on a cylinder raised above the table and set at the proper angle for pitch and side rake of tooth. It must be borne in mind that the pitch angle at the bottom of the thread varies with the diameter.

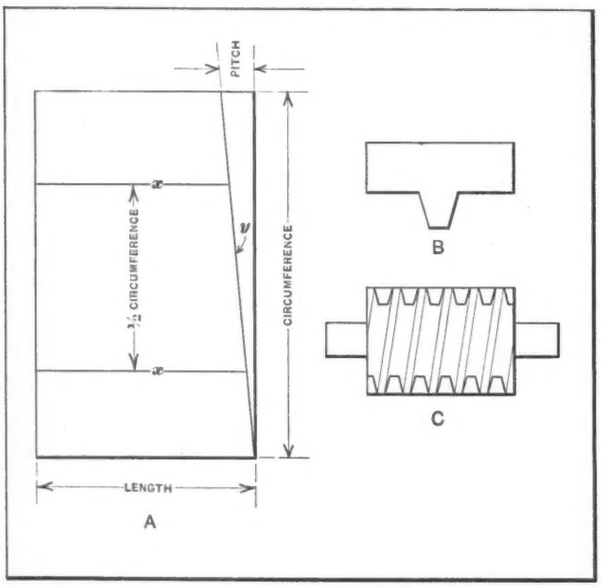



Fig. 8. Method of laying out Worm Pattern by Use of Paper Templet

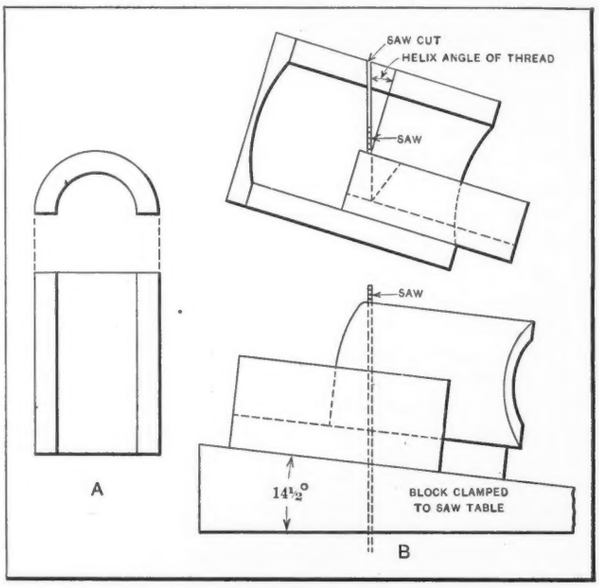



Fig. 9. Method of making Worm and Screw Patterns on a Band Saw

### Patterns for Worm-wheels

Worm-wheel patterns may be made complete with all the teeth or, as is more often the case, the wheel may have a core-print on the rim to carry a segment or part core that forms the teeth. When made with the teeth, the pattern must be parted to mold in a three-part flask (Fig. 7), and the two halves drawn by twisting or screwing them out of the sand, the angle of the teeth preventing a straight draw. The shape of the tooth section is the same as for an involute rack tooth. The helix or spiral angle of the tooth at the point is equal to the helix angle at the root of the worm thread.

The tooth-blocks should be fitted and glued in place, turned, the tooth laid out on the ends and joint, and worked to form, the shape being tested with a templet. When the teeth are finished, the wheel and worm should be mounted on centers in the proper relation to each other and the worm should be revolved to see if it

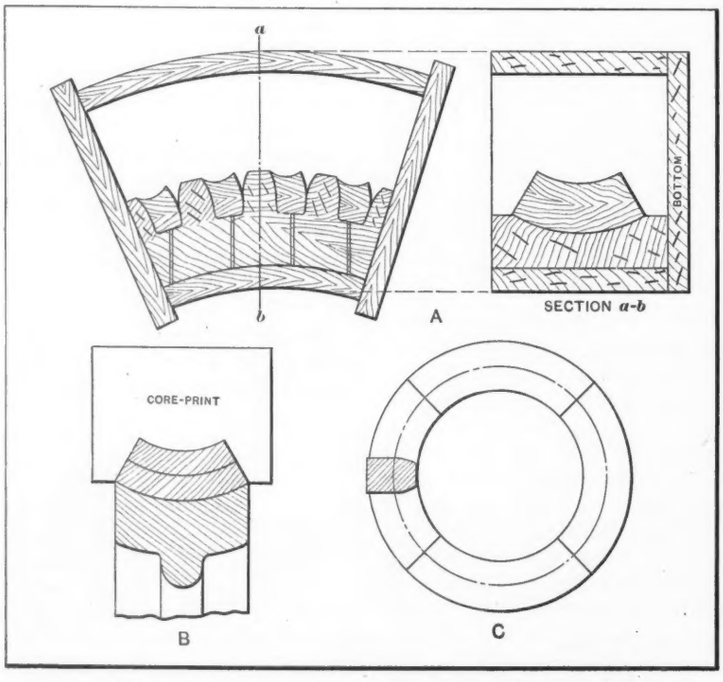



Fig. 10. (A) Segment or Part Core-box for molding Worm-wheel Teeth. (B) Section of Wheel Pattern and Attached Core-print. (C) A Method of forming Worm-wheel Teeth

drives the wheel. It is customary to chalk the worm and trim the teeth of the worm-wheel where the chalk marks the teeth, so as to get the proper contact and clearance. This precaution is always taken; when a segment with five or six teeth is made for a core-box, this same test is always applied.

An easier way of making a worm-wheel is to core the teeth with a segment or part core-box. A core-print is made on the rim of the wheel, as at *B*, Fig. 10, and the core-box is made to include a convenient number of teeth. Care must be taken to have the part included in the core-box properly spaced so that the core will form a complete circle when placed in the mold and make the tooth spacing equal. The segment in the core-box to which the teeth are attached should be cut as at *A* so that the teeth will draw, and the loose pieces should be skewered to the side of the box.

Another method of making the teeth is to glue up some rings of a single course of four segments, with a spline or feather in the joint to hold each ring together. The section of these rings, when turned, is the same as the tooth section (see view *C*), but the outside diameter must be made large to allow for fitting to the throat; four teeth may be made from each ring. Many wheels designed to run with a worm have a straight face and are practically spur wheels with teeth set at an angle.

* * *

## FORMING DIE

By A. T. BOWER

The forming die shown in Fig. 1 was designed for forming the work shown in Fig. 2, and its use saves one operation. The tool has been in use for more than three years without requiring repairs of any sort, about 1500 pieces being made every month. The punch and die may be used in either a small foot or power press.

Referring to Fig. 1, *D* is a cast-iron die-block on which all die parts are mounted. The matrix or holding block *E* is mounted on spring *F*, as shown, and carries two pilots *G* for locating the pieces in the proper position for forming. The stripper *H* is also carried in the holding block, and is actuated by means of a spring. The stationary block *J* is used to form a right-angle bend in the work preparatory to the final forming operation, and is attached by means of screws and pins to the die-block as shown. The punch shown in Fig. 2 consists of a cast-iron punch-holder *K*, which fits into the head of the press and carries the spring-backed forming block *L* and the punch *M*. The punch and forming block

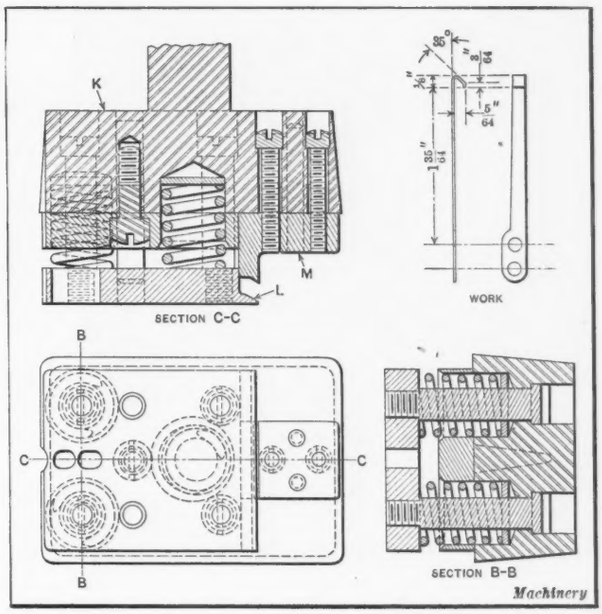



Fig. 2. Construction of Punch used in Connection with Die shown in Fig. 1

perform the final forming operation, which brings the work to the finished shape, shown in the upper right-hand view of the illustration.

The work is first located on the block *E*, Fig. 1, by means of the locating pins. When the ram of the press operates and the punch is brought down, it compresses the stripper and forces the piece down firmly onto the pins. The holding block, being supported by weaker springs than those that support the forming block *L*, Fig. 2, is thus forced downward, carrying the work, which overlaps block *J*, Fig. 1, and results in making a right-angle bend in the piece. This operation results in seating the holding block on the top of the die-block, and the continued downward stroke of the press compresses the springs that support the forming block, and allows the punch *M*, Fig. 2, to operate and carry the upright end of the bent work in and over the forming block. At the completion of the stroke of the press, the formed end of the work has been set to the desired shape between the punch and block. As soon as the upward stroke of the press will permit, the compressed stripper spring expands, operating the stripper and ejecting the work without distorting it. The work is made of soft clock-spring steel, 0.0955 inch thick, and is hardened and tempered after forming.

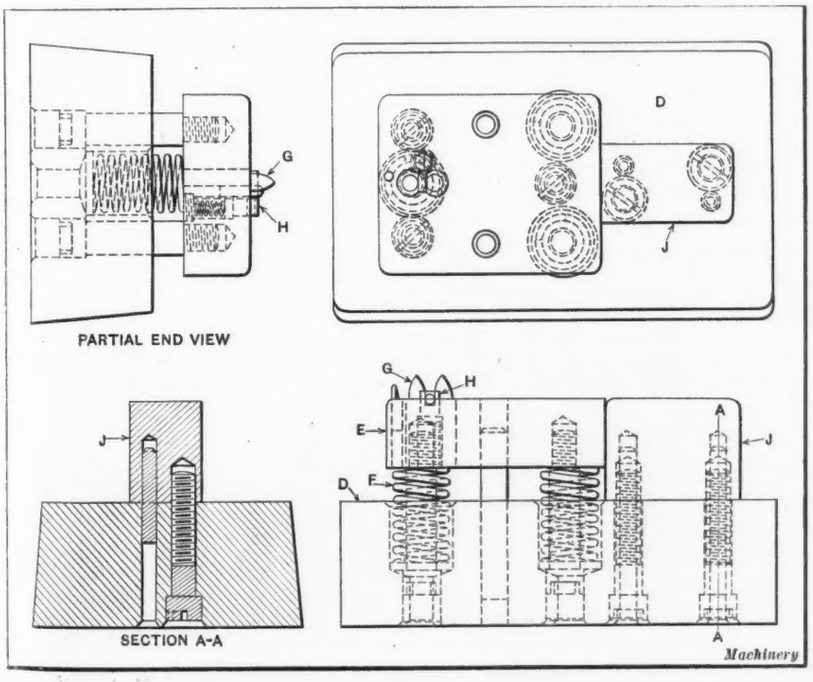



Fig. 1. Die for forming End of Spring Steel Parts

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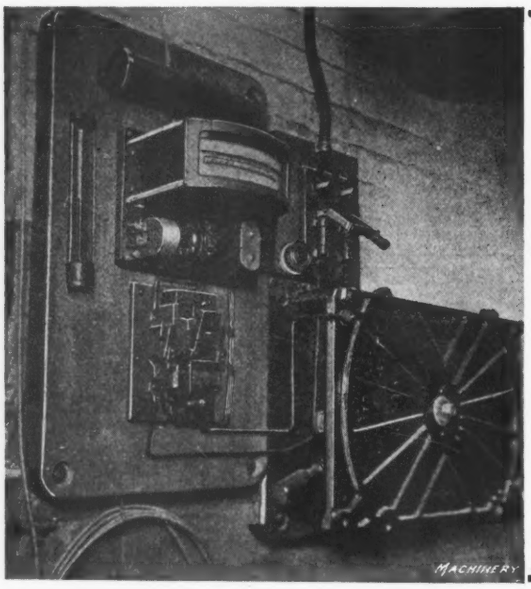
## PRODUCTION OF CORUNDUM AND EMERY

The production of corundum and emery in the United States in 1918 was much smaller than in the two previous years, according to statistics furnished by the Government. The quantity of corundum and emery mined was 10,139 short tons and the quantity of crude emery and corundum that was marketed was 8702 short tons. This output was 45 per cent less than that in 1916 and 52 per cent less than that in 1917, but the production in the two latter years was abnormally large due to the demand created by the war (enormous quantities of abrasives being required for making munitions and other articles for military use) and to the stopping of the importation of corundum and emery.



# Temperature Indicating and Controlling Systems

## Pyrometers for Controlling Furnace Temperatures Automatically and for Recording the Temperature Variations in a Single Furnace or in Several Furnaces which are Successively Connected with the Recording Instrument—The Second Installment

By FRANKLIN D. JONES

Fig. 17. Pyrometer which controls Temperatures automatically

THE type of pyrometer which automatically controls furnace temperatures is a development of the indicating instrument which merely shows what the temperature is when it is connected with the thermo-couple circuit by some form of switch. The automatic controlling pyrometer is so arranged that the moving element of the instrument not only indicates the temperature by its position relative to a scale, but by combined mechanical and electrical apparatus controls the temperature within certain limits by regulating the heat supply. The pyrometer can be set for any temperature desired within certain maximum and minimum limits. If the furnace is electrically heated, the temperature may be regulated by solenoid-operated switches, which either open and close the main circuit, or are used in conjunction with rheostats. In the case of gas or oil-fired furnaces, electrically or pneumatically operated controlling valves or dampers are employed, the opening and closing of these valves being governed by the pyrometer.

One of the Brown automatic controlling pyrometers is illustrated in Fig. 17. The pyrometer, which is of the high-resistance type, is equipped with a mechanism for depressing the pointer at intervals of ten seconds upon contact-making devices. The pointer is depressed by a small motor, and the contact-making device is adjustable throughout the scale range of the instrument, an index pointer showing the temperature to be maintained. The pyrometer itself is practically the same as the type used for automatically controlling temperature signal lights, except that it has two contactors instead of three. When adjusting the instrument for maintaining a certain temperature, a knob is turned until the index pointer is opposite whatever graduation represents the desired temperature. After the switch connecting the instrument with the furnace circuit is closed, the pointer of the pyrometer advances as the temperature increases and when it is over the second contactor, the circuit is opened by a switch indirectly operated through a solenoid relay. When the temperature is reduced to a certain point, the pointer is depressed upon the first contactor and the circuit is again closed; this opening and closing is repeated as may be required to control the temperatures. The temperature may be regulated within 1 per cent of the total scale range of the instrument. For instance, if the range is up to 1600 degrees F., a control of 8 degrees plus or minus, or within a total of 16 degrees, is possible. The regulation may be effected by opening and closing the main circuit; or, by means of rheostats, only a portion of the circuit may be controlled, thus securing a more even regulation.

The Leeds and Northrup recording instrument may be arranged for controlling temperatures automatically either by opening and closing circuits which, in turn, actuate valves, rheostats, or dampers, or by operating the latter directly. The apparatus may be arranged to maintain a constant temperature or to vary the temperature at a predetermined rate or rates. For instance, it may be desirable to maintain a constant furnace temperature until the material is heated to a certain degree, after which the pyrometer automatically varies the temperature. This method of control has been applied where it is essential to heat a mass of material up

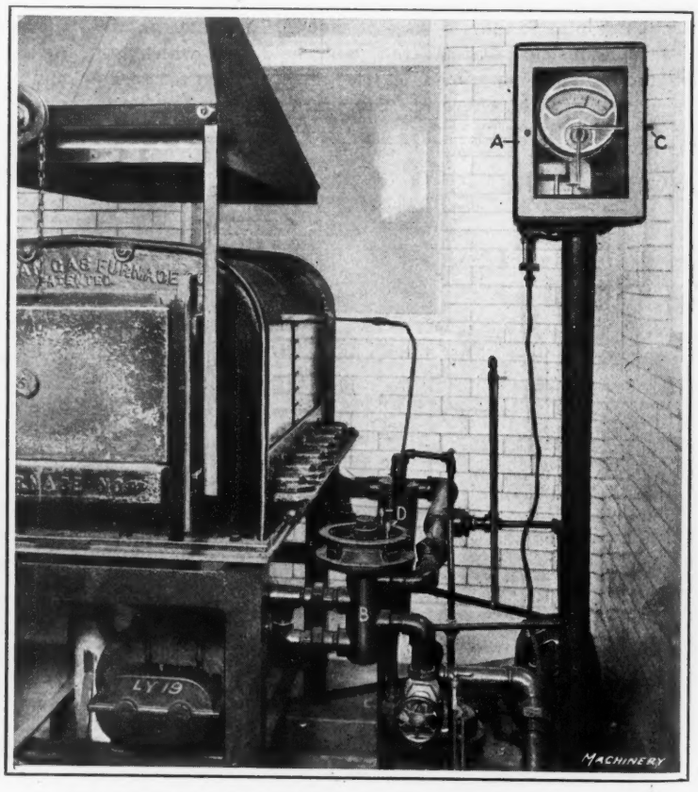



Fig. 18. Pyrometer and Automatic Controlling Mechanism for Gas Furnace

to a certain point and then maintain that temperature, the work being allowed to soak until the temperature is uniform throughout.

### Automatic Controller for Gas Furnace

An automatic controlling apparatus applied to a gas furnace is illustrated in Fig. 18. This apparatus (brought out by the American Gas Furnace Co., 24 John St., New York City) consists essentially of a pyrometer arranged for indicating and controlling the temperature, and a pneumatic valve which is attached to the furnace and operated by the same air pressure that is supplied to the furnace for combustion. In designing a controlling mechanism of this kind, an important part of the problem is to utilize the weak current generated by the thermo-couple to regulate the operation of valves for supplying gas and air to the furnace in the proper proportions. One part of the regulating mechanism is attached to the pyrometer or indicating instrument, located within case *A*, and another part is located at the furnace. The mechanism attached to the instrument or pyrometer is connected by piping with the air supply required for furnace operation. The opening and closing of the pneumatically operated gas-and-air regulating valve *B* at the furnace depends upon the action of the mechanism at the pyrometer, where there is a small air-driven turbine wheel and an arrangement for opening and closing ports that allow air either to escape to the atmosphere or to flow to the valve-controlling mechanism at the furnace. The pointer on the indicator is adjusted by turning a knob *C* at the side of the case, so that it stands opposite the graduation representing whatever temperature is to be maintained in the furnace. The automatic control is derived from two arm extensions, either of which may engage the indicating hand of the pyrometer in order to reduce or increase the temperature by operating the controlling mechanism. These extension arms are located on each side of the pointer which is set to the required temperature. When starting the furnace, the gas and air valves are opened, and the indicator hand moves across the dial as the temperature rises. The left-hand extension arm is stationary at this time, and far enough from the dial to clear the indicator hand, but the right-hand extension arm is in where it will intercept the indicator hand. The right-hand extension arm also has an oscillating movement when in this inner position. Now, when the indicator hand has moved far enough to the right to be engaged by the right-hand extension arm, it is pressed against the dial. The result is that the right-hand extension arm is thrown out to the stationary position and the left-hand extension arm begins to oscillate and is now in position to engage the indicator hand when the latter returns, as the result of a decrease in temperature. The indicator hand is gripped only momentarily by the extension arm and it is free to continue its movement toward the right when the right-hand extension arm moves back to the stationary position. When this tripping action occurs and the extension arms move as described, the mechanism previously referred to closes the furnace gas and air ports. When the cooling of the furnace causes the indicator hand to return far enough to the left to be gripped by the left-hand extension arm, the tripping action is repeated in the reverse order and more gas and air is supplied to the furnace. The mechanism attached to the pyrometer serves to open and close air ports which, by means of a ¼-inch pipe, control the pneumatic gas-and-air regulating valve *B* at the furnace. A maximum and minimum opening for the gas and air ports may be fixed by two adjustable levers *D* which are provided with a graduated scale so that they may readily be reset when starting a furnace that has been shut down. This apparatus is set to control the temperature within a range of 10 degrees F., or 5 degrees above and below the required temperature.

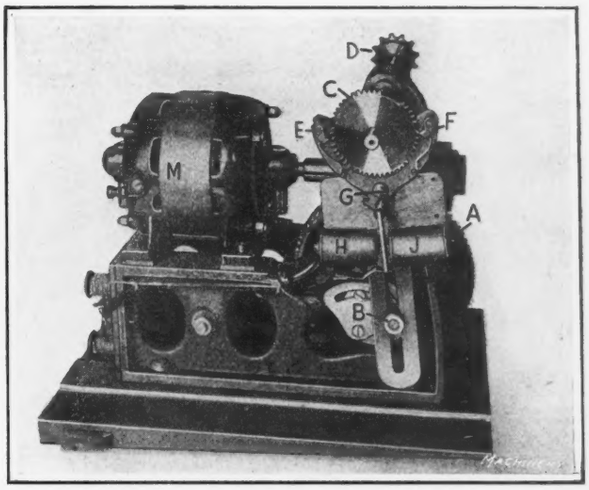



Fig. 20. Motor-driven Automatic Temperature Regulator, the Action of which is controlled by a Pyrometer and Electromagnets

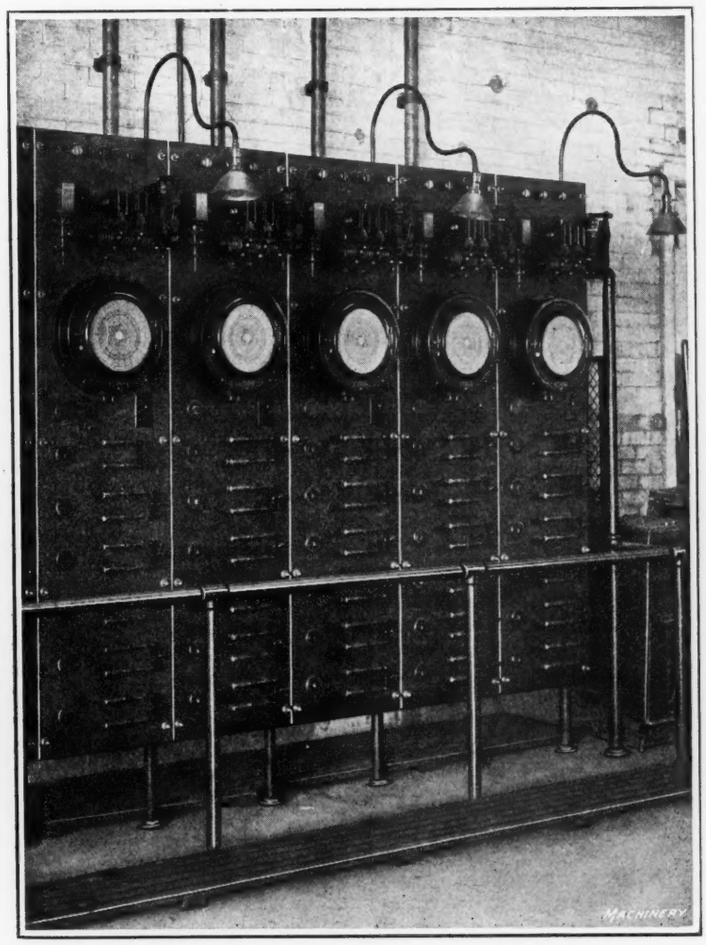


Fig. 19. Installation of Five Recording Pyrometers of Circular Chart Type

### Motor-driven Automatic Temperature Regulating Mechanism

The automatic temperature regulating mechanism shown in Fig. 20 is used in conjunction with a pyrometer for automatic temperature control, and it supplies the power for operating controlling valves, rheostats, or dampers, depending upon the type of furnace. The motor transmits motion to whatever regulating device is used, through a ratchet mechanism which is engaged or disengaged by electromagnets that are controlled by the pyrometer. The illustration shows the controlling mech-

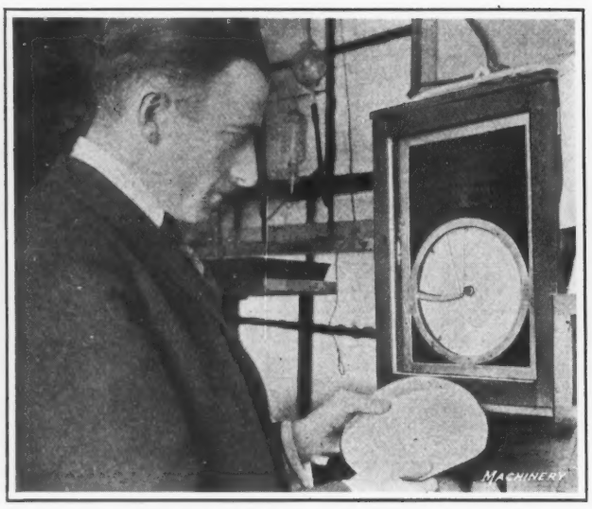



Fig. 21. Recording Pyrometer which is of the Circular Chart Type

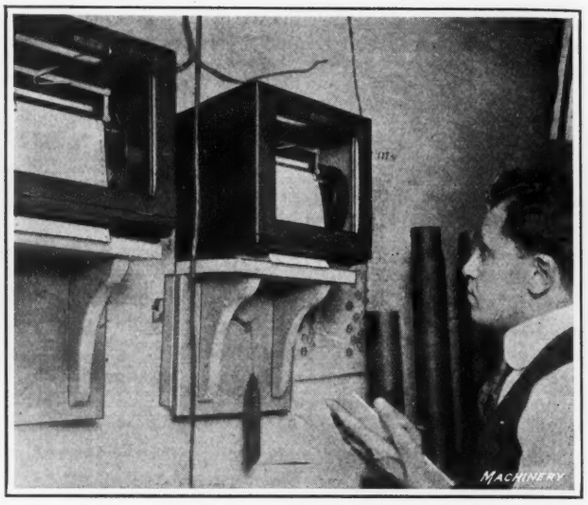



Fig. 22. Continuous Recording Pyrometers in Superintendent's Office

anism with the cover removed. A 1/12-horsepower motor *M* drives a worm which meshes with gear *A*. This gear rotates the adjustable crankpin *B*, which engages a slotted lever, as shown. The lever is pivoted about a shaft carrying ratchet *C* and sprocket *D*. The sprocket *D* is connected with the valve, or other regulating device, by a steel chain.

The swinging movement of the slotted lever does not turn the shaft unless one of the pawls *E* or *F* is engaged with the ratchet. The yoke carrying these pawls is pivoted at *G*, and it is normally held in the neutral position shown in the illustration by a spring at the lower end. When magnet *H* is energized, the yoke is shifted so that pawl *E* is engaged with the ratchet; consequently, the ratchet wheel *C* and sprocket wheel *D* are given an intermittent turning movement in a counter-clockwise direction. When magnet *J* is energized, pawl *F* is engaged and the motion is reversed.

If two connecting valves are to be controlled according to a fixed relation to each other, then the sprockets on the valve spindles are so located that the chain extends around both of them and back over the sprocket on the ratchet shaft. The relative sizes of the sprockets on the valve and on the control mechanism depend upon the motion required. Slow or fast regulation may be obtained by selecting sprockets of suitable size. A considerable degree of adjustability in the mechanism itself is also possible by changing the position of the crankpin *B* so that the pawls pass from one to four teeth at each revolution of the crank.

If only remote control is desired, the current through the magnets is controlled by a two-way switch; but for automatic regulation, the energizing of these magnets is controlled by a pyrometer arranged for this purpose. The pyrometer has two plate contacts located beneath the pointer and insulated by a thin strip at the point where temperature control is desired. This insulated dividing line may be either adjustable or non-adjustable. A depressor bar located over the pointer is controlled either by clockwork or a solenoid magnet. When the depressor bar forces the pointer down, a circuit is completed between the depressor bar and one of the two plates underneath, depending upon the position of the pointer relative to the insulated dividing line. In this way, either magnet *H* or magnet *J* is energized and the heat of the furnace is increased or diminished as may be required.

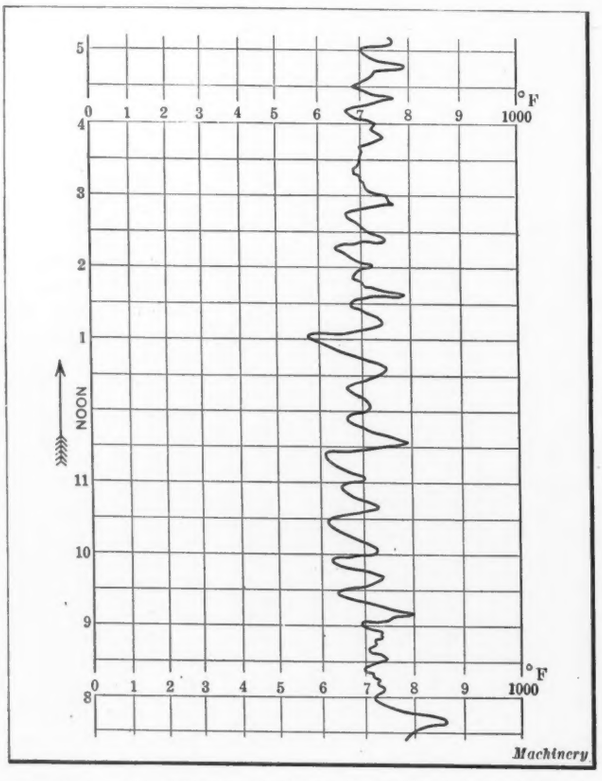



Fig. 23. Section of Temperature Chart obtained from Pyrometer shown in Fig. 22

### Automatic Control for Varying Temperatures

The regulating mechanism illustrated in Fig. 20 may be used in conjunction with a pyrometer arranged to control the temperature along a time-temperature curve instead of maintaining it at a fixed point. To obtain this varying control, the pyrometer has a drum which revolves beneath the pointer of the instrument, this drum being driven and timed by clockwork. About the drum are wrapped two thin brass plates which are electrically insulated along the inner edges. The contour of one edge, if developed, would correspond with the minimum temperature time rate required, and the other edge corresponds in contour to the maximum time-temperature curve. Therefore, the thin insulated gap separating these two plates represents the time-temperature curve.

The instrument has a depressor bar which presses the pointer on the needle against the contact plate beneath, the arrangement being similar to that already described for the apparatus arranged for fixed temperature regulation. As the pointer comes into contact with one of the plates on the drum, a low-voltage current energizes one of the magnets and increases or decreases the temperature, depending upon whether the minimum or maximum contact plate is in contact with the pointer. As the drum revolves, the temperature automatically changes to agree with the curvature of the insulating gap between the two plates. The degree of opening or closing for one operation of the depressor bar depends, first, upon the ratio of the sprockets, second, upon the setting of the crankpin, and third, upon the length of

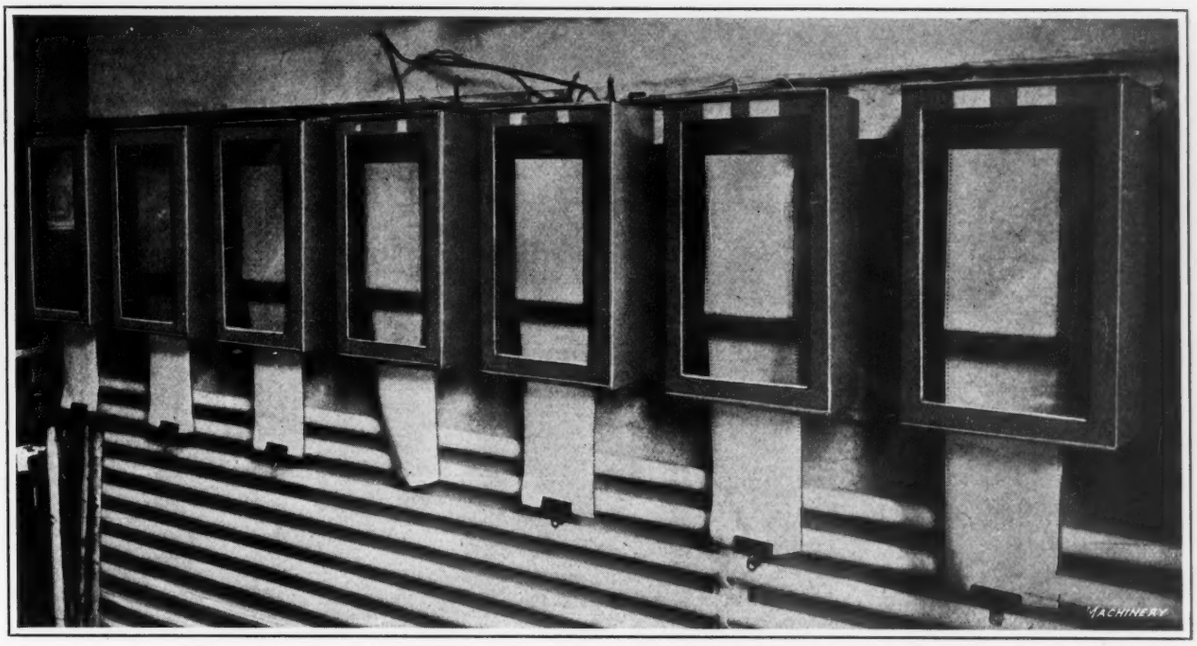


Fig. 24. Two-record Recording Pyrometers. Each of which has Two Millivoltmeter Movements mounted Side by Side

contact between the depressor bar pointer and the plate beneath. All of these are adjustable so that a wide range of regulation is possible. This apparatus may be used for controlling dampers, valves, rheostats, or any other rotatable member, and is a recent development of Charles Engelhard, 30 Church St., New York City.

### Obtaining Temperature Records Automatically

The charts or records of temperature variations obtained by means of recording pyrometers are not only valuable for future reference, but also enable the superintendent, foreman, or attendant to watch readily the operation of any furnace by inspecting the chart whenever convenient. Besides showing the temperatures, the charts indicate the general trend of any changes which may occur. The use of recording instruments tends toward greater uniformity in the quality of heat-treated products. A recording pyrometer is provided with some kind of marking device which traces either a continuous or a dotted line upon a chart graduated with reference to temperature and time. By referring to one of these charts, the temperature at any period within the range of the chart is shown graphically. The chart may be graduated in minutes of time and may cover a total range of, say, two hours, or the main divisions may represent hours and cover either a twelve-hour period or a twenty-four hour day. Pyrometers are also made to give a continuous record over long periods. These charts differ in form, some being circular disks and others of rectangular shape.

The Brown recording pyrometer of the type having a circular chart is shown in Fig. 21. Graduation lines in the form of concentric circles represent degrees of temperature, and radial arcs represent intervals of time. The pointer arm is permitted to swing freely and is brought into contact with the chart only momentarily in order to avoid frictional resistance which would affect the accuracy of the record. The contact between the pointer and paper chart may occur every minute or half minute, as regulated by the clock mechanism. Either a parchment or paper chart may be used. The former has a sheet of carbon behind it and the record is made on the back of the parchment sheet, but is clearly seen from the opposite side. When white paper charts are used, a carbon band passes between the chart and the marking pointer. A graduated bridge extends across the face of the chart on the left-hand side and shows what temperature the curve represents at any point between the main graduation lines.

The Hoskins recording pyrometer is another design having a circular chart. Five of these pyrometers, installed at the

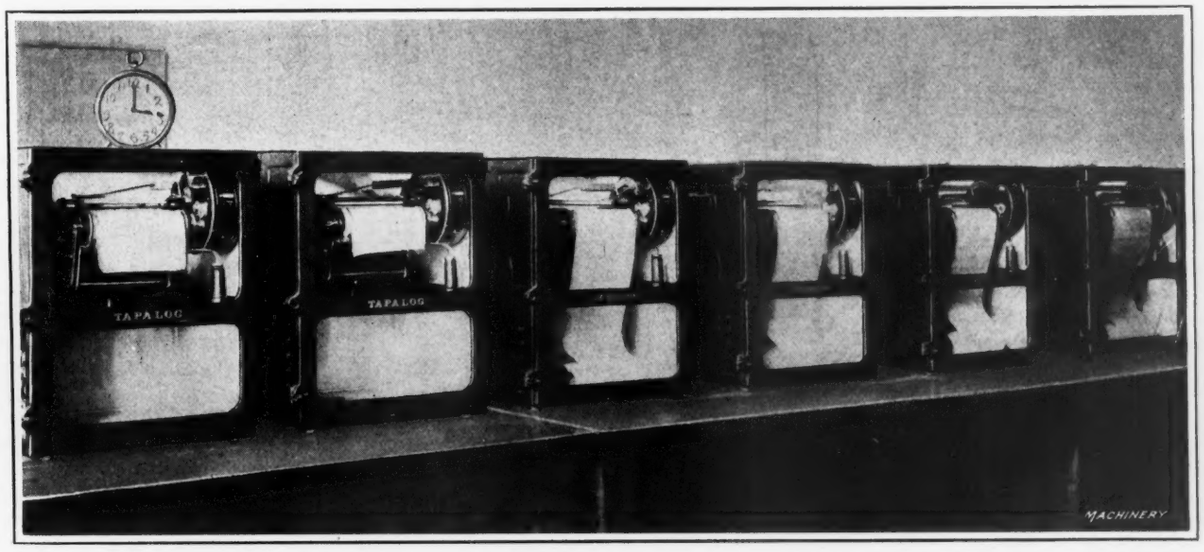



Fig. 25. Six Recording Pyrometers arranged for producing Multiple Records

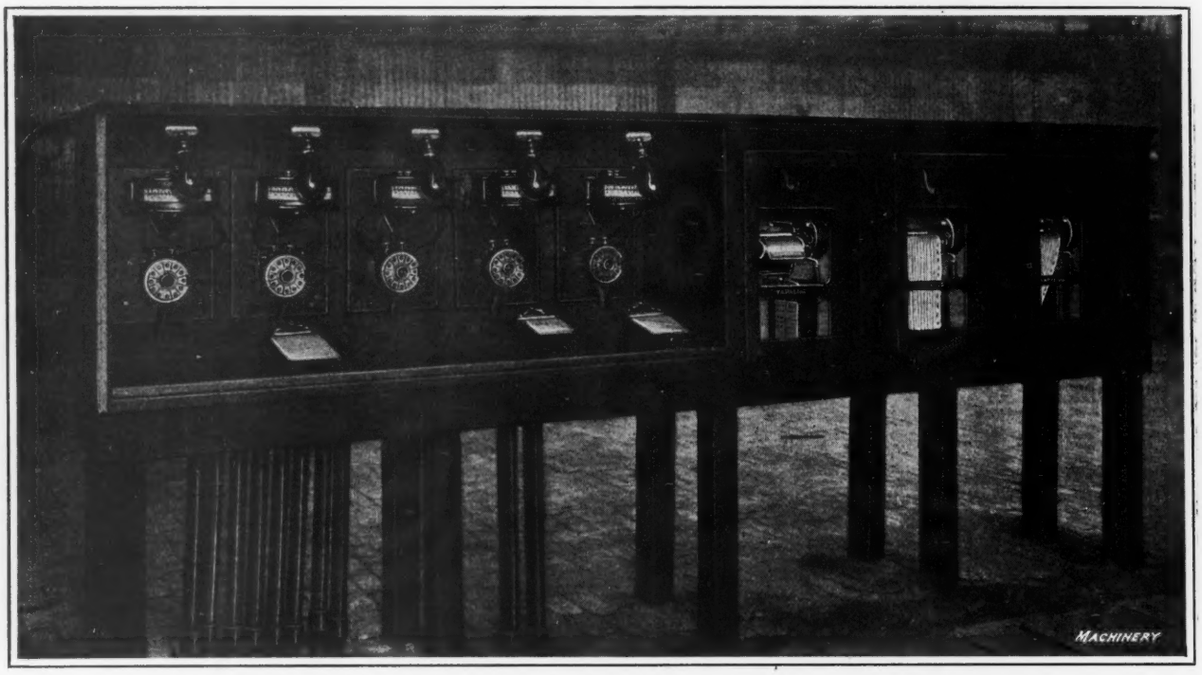


Fig. 26. An Installation of Five High-resistance Indicating Pyrometers and Three Multiple Recorders

plant of the Burroughs Adding Machine Co., are shown in Fig. 19. The rotation of this chart is derived from a clock movement. This clock also actuates, through a cam-driven striking arm, a metal stylus carried on the end of the pointer. The arm is curved to correspond with the arc through which the end of the pointer moves. Back of the chart, which is thin and translucent, there is a circular disk of carbon paper, and at intervals of a half minute the small stylus or metal point is pressed against this paper, thus making a dot on the back of the chart. These dots, which are plainly visible from the front of the chart, are closely spaced and form practically a continuous line as the chart revolves. Continuous records of temperature over periods of either twelve or twenty-four hours may be obtained. If desired, two records may be made simultaneously, just as duplicate letters are produced on the typewriter.

The Leeds & Northrup recording pyrometer (potentiometer type) has a small electric motor for adjusting the potentiometer as regulated by the position of the galvanometer needle. The motor serves to keep a reciprocating part constantly in motion. This part does not come into contact with the pointer while the latter is in the central or no-current position. When the pointer moves to the right or left, however, it is engaged by the reciprocating member, and the potentiometer circuit is regulated until the galvanometer needle has been returned to its central or no-current position. The regulation is designed to be proportional to the temperature change. The chart drum and recording pen are also operated by the motor. The chart moves over the drum which is driven through gears by the motor, and the pen draws a continuous line on the chart corresponding to the temperature. The horizontal lines on the chart represent time and the vertical lines, temperature. The chart lasts for thirty days. A constant speed is insured by a centrifugal governor of special design, provided for the purpose of opening and closing a shunt in the field circuit. Indicating pyrometers are often used in conjunction with the recording type, a common arrangement being to install the indicating pyrometer near the furnace and place the recorder in an office.

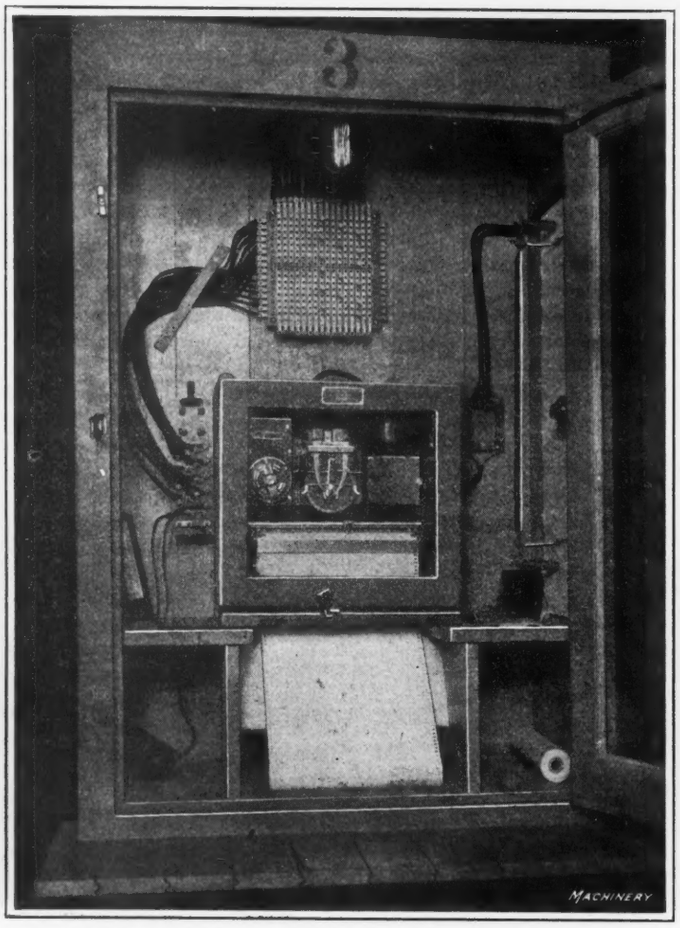


Fig. 27. Multiple-point Recording Pyrometer of the Potentiometer Type

### Continuous Temperature Records

Continuous temperature records covering long periods are often desirable, and some recording pyrometers are designed with this object in view. A Leeds & Northrup recorder having a chart which lasts thirty days has just been referred to. Another type of pyrometer, made by the Taylor Instrument Companies, which is capable of producing a continuous record is shown in Fig. 22. This installation of two

pyrometers is in the office of the superintendent. With this type of instrument it is necessary to change the chart only every fifty days. The knife type pointer of the instrument is periodically pushed down, the pointer intercepting an impregnated thread, which is pressed against the chart, thus making a dot. These dots are so numerous or so closely spaced as to form a continuous line, even though the temperature variations fluctuate rapidly. When the pointer is not depressed, it is free to assume the proper position. Horizontal lines on the chart represent intervals of time and vertical lines, degrees of temperature. A section of one of these charts is reproduced in Fig. 23. This particular chart is graduated up to 1000 degrees F., the figures 1, 2, 3, etc., representing hundreds of degrees. The vertical sub-division lines between the hundred-degree lines have been omitted.

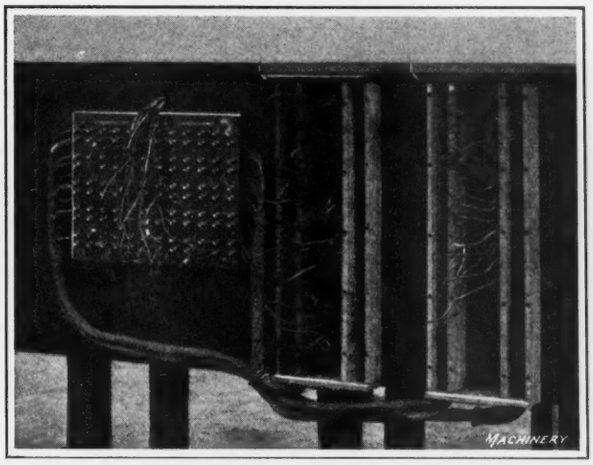


Fig. 28. Rear View of Installation shown in Fig. 26, illustrating Slate Panel and Selective Connection Posts

The Brown continuous recording pyrometer is so arranged that the record is produced by a pointer that strikes a strip of carbon paper and forces it against the record paper, thus forming the line consisting of a series of closely spaced dots. The roll of carbon paper passes over the record roll, and the pointer strikes the carbon band once a minute for producing the record. The record paper and carbon band will last two months without renewal. The pyrometer designed for producing a single continuous temperature record is similar in appearance to the double-recording instruments shown in Fig. 24. The multiple type of recording pyrometers will now be referred to.

### Pyrometers for Automatically Recording Temperatures of Different Furnaces

Where a heat-treating plant contains two or more furnaces, a pyrometer may be installed that will record automatically on a chart temperature variations in each furnace to which it is connected. This type of pyrometer is generally used when the heat-treating process requires a half hour or more for its completion. The pyrometer may be designed especially for multiple recording or have an auxiliary connecting or switching device. For instance, the recording pyrometer shown in Fig. 22 may have an automatic contact switch which enables it to record the temperatures of eight thermo-couples. This automatic switch is a separate and complete unit. Each contact point is closed for approximately seven minutes during each hour when connection is made with eight couples. When the number of couples is reduced, more records per hour can be obtained. An index shows which thermo-couple is in circuit, and this index may be rotated manually to determine the temperature of any thermo-couple, which makes it unnecessary to wait for it to come into circuit.

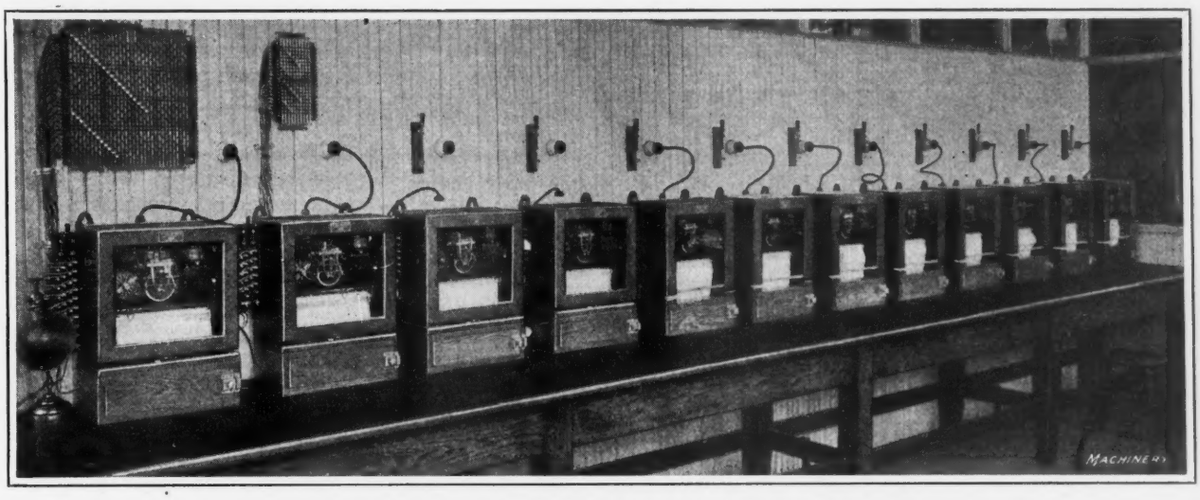


Fig. 29. A Battery of Pyrometers Similar to the Type shown in Fig. 27

Fig. 30. Pyrometer which records Temperatures of Different Furnaces on a Circular Chart

The Brown multiple recorder will produce from two to eight records on one chart, and when four, six, or eight records are needed, these are printed on the chart in different colors to avoid confusion. When records of only two thermo-couples are required, these are made in the same color on independent parallel charts which are on one record sheet. This multiple recorder has two millivoltmeter movements. No

switching mechanism is required for two records, but for a larger number an automatic switching mechanism is utilized. A pointer and scale at the top of the instrument indicates the temperatures of the furnaces at all times.

The installation of two-record recorders, shown in Fig. 24, is at the South Works of the J. I. Case Threshing Machine Co., Racine, Wis. There are eight of these two-record recorders in the complete installation, although only seven are shown in this particular illustration. As each recorder is a duplex form of instrument, the temperature records of sixteen thermo-couples are obtained. It would be possible to replace the eight pyrometers with, say, two pyrometers, each capable of producing eight temperature records. The instruments, however, having individual millivoltmeters for each furnace or thermo-couple are preferred for many installations.

A battery of six Wilson-Maeulen Co.'s recorders designed for producing multiple records is illustrated in Fig. 25. This same general type of recorder is also arranged for producing single records. In either case, the records are formed by the series of dots made at ten-second intervals. With the multiple recorder, the instrument is connected with each thermo-couple circuit long enough to produce eight of these dots; the recorder is then automatically switched in circuit with the next thermo-couple. A dry battery is used to provide power for operating the recording mechanism, and a clock movement controls the rate at which the record paper advances and the switching in of the automatic commutator, but is not required to furnish power. The dotted lines for different circuits are printed in various colors, the printing ribbon being periodically shifted by a crank action for locating the proper color for the circuit in the recording position.

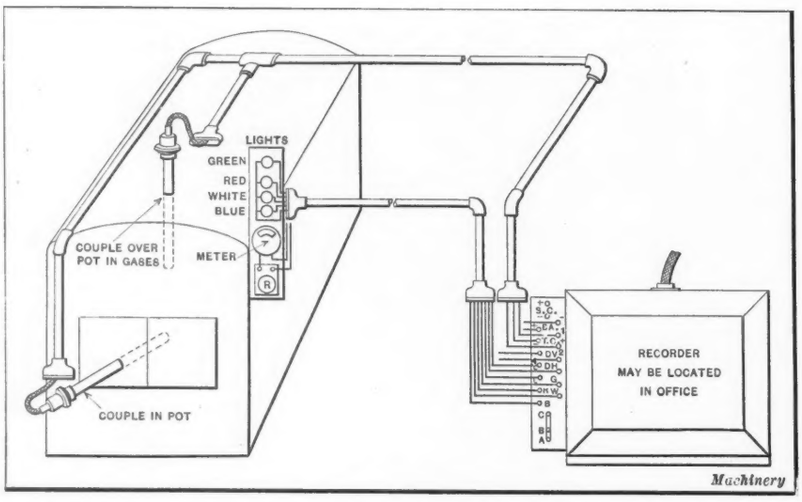



Fig. 31. Diagram showing Connections for a Double Recorder which is alternately connected with Two Thermo-couples in a Furnace

Another installation of Wilson-Maeulen multiple recorders is shown in Fig. 26, which also illustrates this company's high resistance indicating instruments. The three multiple recorders are in the compartments at the right, and the five high-resistance indicators at the left. Each multiple recorder produces six autographic records in as many different colors on one record sheet, giving a total of eighteen records. A selective device mounted at the back of the instruments enables the pyrometers to obtain records from whatever furnaces are in operation. The rear view, Fig. 28, shows the slate panel and the selective connection posts for the different couples. The flexible leads from the pyrometers for selective connection to these posts may also be seen in this illustration. The monopivot, high-resistance, long-scale indicators at the left of Fig. 26 are equipped with rotary switches with eleven points on each switch, making a total of fifty-five thermo-couples which are located in four horizontal and two vertical furnaces that are used for the heat-treatment of long propeller shafts.

The Leeds & Northrup multiple-point recorder (see Fig. 27) produces a succession of dots with a number beside each dot corresponding to the number of the thermo-couple in circuit. For instance, the record of thermo-couple No. 4 is indicated by a succession of dots with No. 4 beside each dot. A pointer moves with the print wheel and indicates the temperature at all times. The paper or chart is moved sufficiently between each printing to prevent two dots or numbers representing the same temperature from being printed on each other, thus blurring the record. One record is printed each minute so that the period required for a complete cycle depends upon the number of furnaces or thermo-couples connected with the instrument.

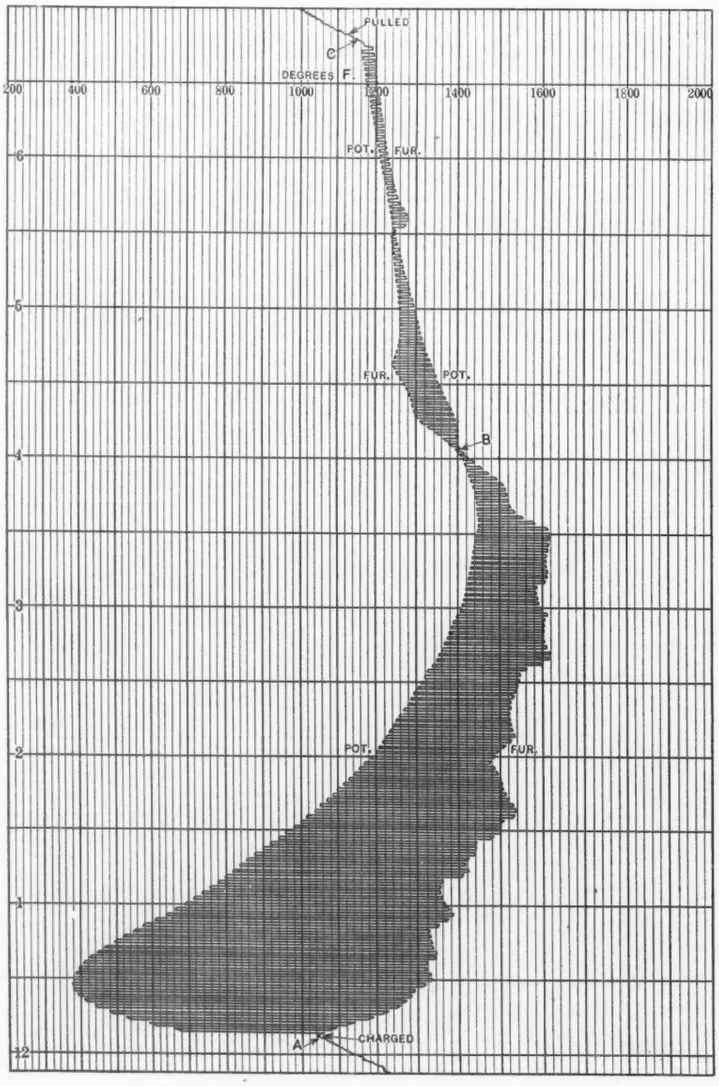



Fig. 32. Chart obtained from Double-recording Pyrometer, showing Temperature Variations between Annealing Pot and the Furnace Gases

For example, with an eight-point recorder eight minutes elapse between successive records of the same point, whereas with a six-point recorder six minutes elapse. These recorders are provided with an automatically operated rheostat, so that changes in the voltage of the dry battery used with the recorder will not affect the records. The motor of this instrument operates a selective switch for connecting it with different circuits, and also turns the printing wheel in unison for printing the dots and identifying numbers on the chart. Part of the installation of multiple recorders at the plant of the Maxwell Motor Co., is shown in Fig. 29.

The Hoskins multiple recording pyrometer may be used in conjunction with any number of thermo-couples up to ten. The record is formed by a series of red-ink dots. Indentations are made in the chart by a pointed stylus which receives an impact from a "hammer frame" every twenty seconds, and the ink is applied at the same time that these high points are formed. As a given thermo-couple circuit is closed for a period of one minute, three perforations are made before the next thermo-couple is in circuit; hence, these three points indicate any fluctuation of temperature in a furnace during the one minute period. The chart is so arranged that the three perforations or dots are recorded in a space bearing the number of whichever thermo-couple happens to be in circuit. When ten thermo-couples are connected with the pyrometer, a three-point reading is obtained from each thermo-couple every ten minutes. When there is a smaller number of thermo-couples, the unused circuits can be utilized for obtaining extra or more frequent readings, as for example, from lead pots or from equipment subject to rapid temperature changes.

The recording pyrometer seen at the left-hand side of Fig. 30 (made by the Beighlee Electric Co., Cleveland, Ohio) is designed to record temperatures from one, three, six, nine, or twelve thermo-couples on a circular chart. The records are entirely separate for each thermo-couple and are produced by an electric spark which burns a series of small perforations in the chart. The instrument has a self-contained automatic Wheatstone bridge system which compensates for any temperature variations that may occur at the cold junction of the thermo-couple. This instrument is of the high-resistance type.

### Recording Temperatures at Different Points in the Same Furnace

Some of the furnaces used for the heat-treatment of steel require more than one thermo-couple, especially if the heating chamber is large and temperature variations in different parts of the furnace are likely to occur. For instance, large furnaces for annealing, hardening, or tempering, might have two or more thermo-couples located to the best advantage for indicating a lack of uniformity in the temperature. The arrangement might be such that any of these thermo-couples could be connected with an indicating pyrometer through a hand-operated selective switch; or a multiple recorder might be employed, in which case each thermo-couple would, in turn, be automatically connected with the recorder.

The Leeds & Northrup multiple-point recorder shown in Fig. 27 happens to be used in conjunction with a vertical furnace which is employed for heating long parts such as gun tubes, preparatory to hardening or drawing them. This furnace, which is 40 feet high, is provided with three thermo-couples, one being located near the lower end of the heating chamber, one at the center, and one near the top. A temperature record is printed on the chart each minute so that three minutes elapse between successive records of the same thermo-couple. The pyrometer chart shows the temperature at any given time as well as the variations that may occur in different parts of the heating chamber. This chart is also a complete record of the entire heating process from start to finish. The furnace referred to is arranged to receive thermo-couples at various other points around the heating chamber, and at several different levels, in case three thermo-couples are not considered sufficient. The bus-bar board seen just above the recorder is used to make whatever changes in the connections may be required.

Fig. 31 shows diagrammatically the connections for a Leeds & Northrup double recorder having a commutator for obtaining readings alternately from two thermo-couples in a furnace. In addition, temperatures are indicated by a meter at the furnace and an extra signal lamp shows which thermo-couple is in circuit. This double recording instrument shows not only lack of uniformity in the furnace temperatures, but also the changes which occur when the furnace is empty, partly filled, or entirely filled with work. One object in using two thermo-couples is to observe how the distribution of heat is affected by such factors as the position of the work and the furnace door, the rate of firing, etc. The effects due to the location of the thermo-couples relative to the work may also be observed and conditions in the furnace improved by changes in the burners or other parts, as well as in the method of introducing heat. The chart obtained from this instrument is a single line running alternately back and forth between the two temperatures and showing the temperature difference graphically. The fourth signal lamp at the furnace for indicating which thermo-couple is in circuit, is used in addition to the three signal lamps for temperature regulation. This double recording equipment is considered of especial value for studying the heating of different pieces which may vary as to the size of section or number, and the duplex record may be used for determining the speed of loading and unloading, different methods of loading, etc.

### Double Record from Furnace Having Two Thermo-couples

A sample chart obtained from the double recorder referred to in the preceding paragraph is illustrated in Fig. 32 and shows the temperature variations in an annealing furnace. The parts to be annealed are packed in a pot and one thermo-couple is inserted in this pot. The other thermo-couple is subjected to the temperature of the hot furnace gases. The horizontal numbered lines on the chart represent hours, and the main vertical lines, hundreds of degrees Fahrenheit, with 20-degree sub-divisions. The point *A* on the chart corresponds to the time when the furnace was charged. The two temperature curves on the chart are indicated by the right- and left-hand edges of the inked-in section formed by the pen, which moves back and forth as the instrument is alternately connected with first one thermo-couple and then the other. The temperature of the thermo-couple in the pot is reduced at first, owing to the fact that it is inserted in a cold pot (this thermo-couple has been heated previously while the contents of another pot were being annealed). After this preliminary cooling, the temperature gradually rises until point *B* is reached, where the temperature of the pot and of the furnace heating chamber are alike. From this point on, the heating chamber is somewhat cooler than the pot, the heat being reduced so that the pot cools slowly. In this particular case the pot and its contents were removed from the furnace when the temperature had been reduced to the point indicated at *C*.

This chart illustrates how the temperature of the hot furnace gases may differ from the temperature of the work. If the pyrometer simply indicated the temperature of the hot gases, it would be impossible to determine just when the temperature of the annealing pot and its contents were equal to the furnace temperature. Variations between the temperature of the heating chamber and the work accounts for many difficulties experienced in the heat-treatment of steel. The furnace is heated to what is believed to be the right temperature according to the pyrometer reading, but the relation between this furnace temperature and the actual temperature of the work is not known and possibly not considered. While the furnace referred to in connection with Fig. 32 might have had a single thermo-couple inserted in the pot, the second thermo-couple shows the relation between the temperatures of the work and the furnace chamber, and permits the furnace to be regulated accordingly and to be operated more economically.

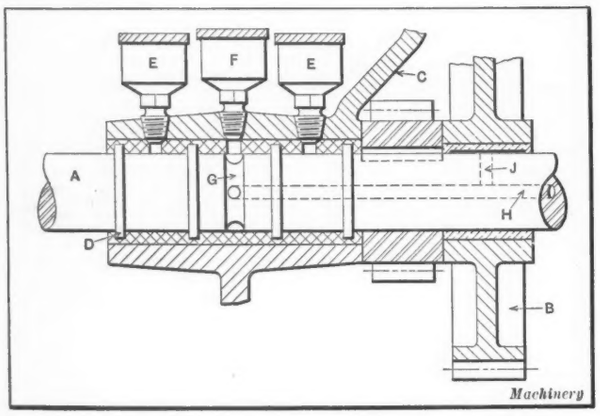



Fig. 1. Lubricating Arrangement for a Gear within a Housing

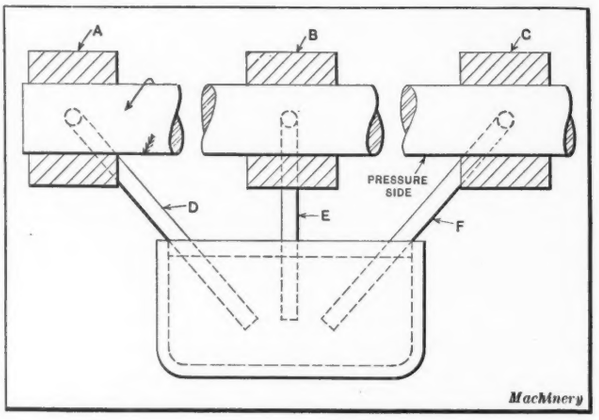



Fig. 2. Example of Multiple Capillary Lubrication

# Oiling and Lubricating Devices

## Some Methods of Lubricating Inaccessible Bearings

By OTTO ABDT

IN designing machinery, the important factor of lubrication is often neglected until the point is reached where it becomes necessary to resort either to changes in design or to some unusual means of supplying lubrication. It is not always best to sacrifice design in order to incorporate lubrication features, but on the other hand provision for lubrication should not be omitted in order that other features in the design may be improved. Perplexing problems involving this question often occur, and therefore a few representative examples which have proved their practicability are here presented.

Fig. 1 illustrates provision for grease lubrication of a shaft which is journaled in a fixed frame and which has a gear *B* independently revolvable on shaft *A* (in a reverse direction to that of the shaft) and housed within a casing *C*. Rings *D* are turned on the shaft for the double purpose of taking up end thrust and of confining the grease which is fed between them from the cups *E*. Grease is also fed from the cup *F* into groove *G*, whence it passes through holes provided in the groove to the conductor *H*, drilled along the center of the shaft, the grease being forced out through the outlet *J* into the bearing of the gear.

An example of multiple capillary lubrication for inaccessible bearings is shown in Fig. 2. The bearings *A*, *B*, and *C* are supplied with oil from a tank by means of the copper tubes *D*, *E*, and *F*, respectively, which are packed lightly with cotton wicking. The tubes extend well into the tank as may be seen, and are securely fastened in the bearings by swaging them into holes provided for this purpose. It is necessary to swage the tubes into the bearings in order to provide an air-tight connection. It is not essential that the wicking should touch the shaft, although it should extend very close to it. The tubes should be fastened to the bearings at an angle of 90 degrees with the pressure sides, with reference to the direction of rotation of the shaft, as shown by the arrow.

Fig. 3 shows a method of lubricating a gear which is mounted on a sleeve and a shaft bearing located within a housing, where, on account of the interference of gear *A* and a traveling table-top, the bearing is inaccessible. Grease is conducted from the cup *G* through the drilled hole *D* in the stud *C*. The bearing of gear *A* is lubricated through hole *E*; and for the purpose of supplying bearing *B*, a copper tube *F* is inserted in the hole as shown. If care is not taken to fill all the passages with grease before this arrangement is used, the result will probably prove disastrous.

In the illustration Fig. 4, an emergency remedy is shown for lubricating a bearing that continued to become overheated in spite of the use of several methods to prevent this trouble. The device is merely a tin funnel soldered to a nipple *B* which is screwed into the pipe tap that was originally provided for an elaborate oil-feeding device and which had failed because of the inaccessibility of the bearing. Surrounding gears and moving parts made it impos-

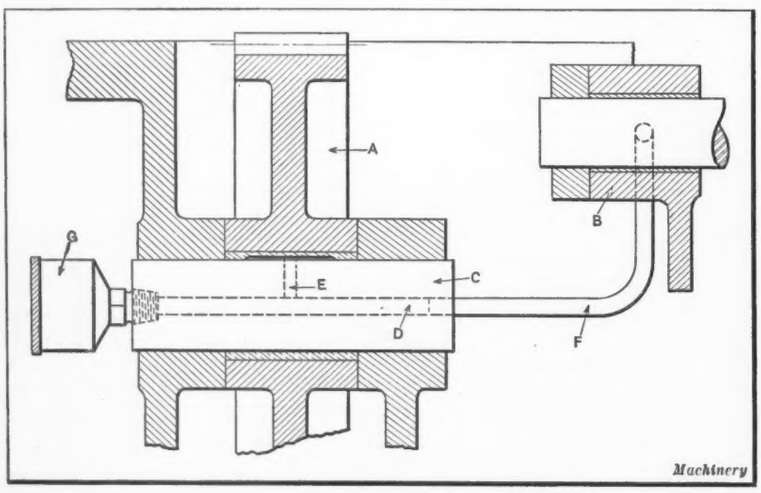



Fig. 3. Method of conducting Grease to Inaccessible Bearings

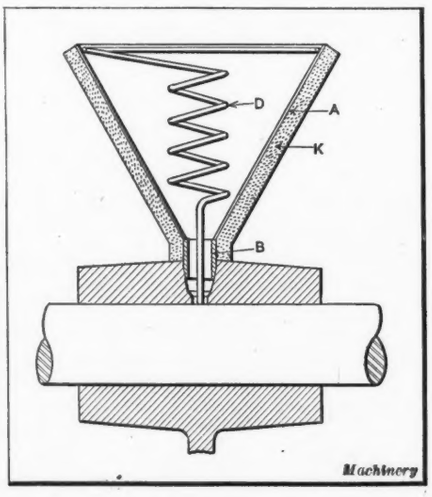



Fig. 4. Funnel for feeding Grease to Bearing

sible to run a line of tubing to the bearing from a fixed tank. It will be noted that the funnel is encased as shown at *K* with asbestos, or some similar material, and that a coiled copper wire *D* leads down from the top, its end resting on the shaft. The funnel is packed with light grease to which the heat from the bearing is conducted by means of the wire and the sides of the funnel, causing the grease to melt and run down into the bearing. A tin cover may be used to keep out dirt, if desired. This improvised arrangement furnishes a good lubricating device and one that needs but little attention.

The writer has found that in the case of certain classes of enclosed gears which run at high speed, trouble is likely to be encountered in keeping the entire unit cool if too much oil is used. This trouble will also occur, of course, in the same units when too little oil is used, but with the correct amount of the same kind of oil this condition will be practically eliminated.

* * *

## MAKING PIG IRON AND SPIEGELEISEN FROM SCRAP STEEL

A patent was recently granted which covers a method of making pig iron from scrap steel. In certain parts of the United States Bessemer pig iron cannot be made on account of the high content of metalloids, such as phosphorus, contained in the ores from which the pig iron is made. The patentee contemplates the use of all-steel scrap of a suitable nature to produce a Bessemer grade of pig iron, without the addition of any ore to the charge. The blast furnace is charged entirely with steel scrap, with the requisite percentage of a flux, and with coke for the purpose of melting the scrap and furnishing the carbon for recarburizing the molten product in the furnace. The smelting is then carried on as usual. By this process a grade of pig iron is produced which cannot be obtained directly from the use of ores carrying phosphorus in excess of the Bessemer limits. The iron so produced can be used for many purposes for which high phosphorus irons are not suitable, such as the manufacture of ingot molds for steel works and as recarburizing materials used in the manufacture of high-carbon steels. This same process can also be used in producing spiegeleisen. By introducing into the charge of the furnace a small proportion of manganese ore with the scrap, flux, and coke, a regular grade of spiegeleisen can be produced, which it is impossible to do now from ores carrying phosphorus in excess of the Bessemer limits.

* * *

## THE EMPLOYMENT SERVICE OF THE DEPARTMENT OF LABOR

Vigorous efforts are made by the Department of Labor to maintain and extend its employment service. The Secretary of the Department asks for an appropriation of $14,000,000 for its maintenance during the coming year. The advantage of a free public employment office over one maintained for private profit is apparent, because it is well known that many evils have crept into the private employment agencies and that they are in many cases parasites on both employer and employe. A federal employment service, however, is also open to criticism under our political system. It lends itself too well to political patronage and it has also been intimated that the service has discriminated between union and non-union labor. Free federal employment offices must make no such discrimination nor must they differentiate between closed and open shops. If conducted in an absolutely impartial manner and by men who do not hold office because of political patronage, the service would be ideal. Whether it is possible to obtain an employment service so conducted is open to question and on this point more than on any other do the manufacturing industries of the country need assurance before they will be willing to give their support to a bill for the expenditure of $14,000,000 for the federal employment service.

## FORMING AND PIERCING DIES FOR PRONGED COLLETS

By BURNETT MENKIN

The combined punch and die here illustrated was designed by the writer to provide means for forming and cutting the prongs in a collet in one operation. An excellent idea of the construction will be obtained from the illustrations. The die bed *A* has a central opening in which is seated a cutting die *B* which is also provided with a central opening in which the flanged collar *C* is a sliding fit. The flange of collar *C* operates in the enlarged opening in the cutting die and is supported upon three upright posts *D*, the lower ends of which are fixed in the ring *E*, this ring resting upon the cylindrical counterbalance *F*. The counterbalance is securely seated in the buffer plate *G*, which is mounted upon the buffer springs *H*, these being coiled around two bolts, as shown. The tension of the springs is such as to normally hold the flanged collar *C* in a raised position against the

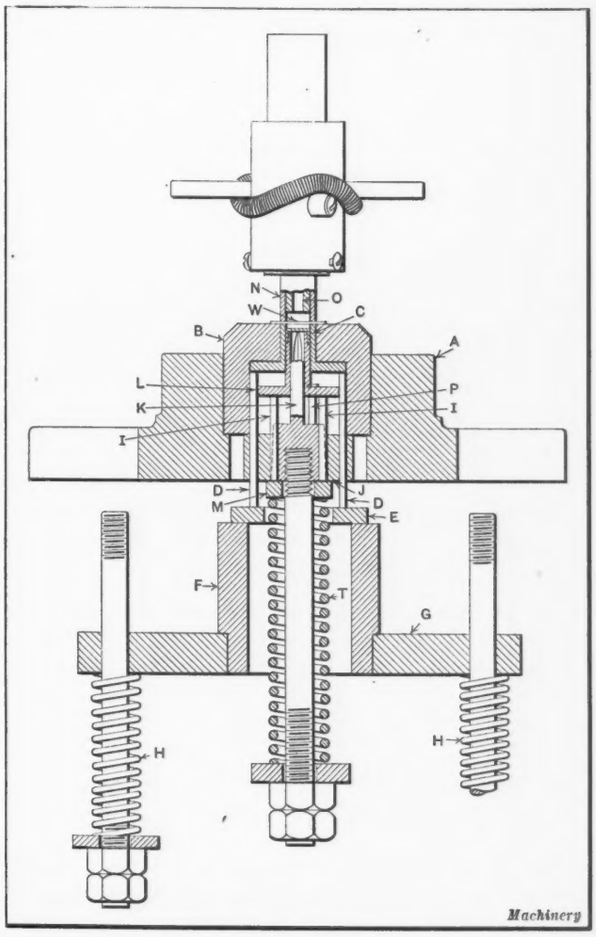



Fig. 1. Sectional View of Punch and Die for forming and cutting Prongs in a Collet in One Operation

interior horizontal wall of the cutting die *B*, the posts *D*, as will be seen, sliding through holes in the fixed ring *J*. The butt end of the spear-shaped punch *K* is secured in ring *J* and is screwed on the upper end of a bolt, the tension arrangement of which is similar to, though stronger, than the buffer spring construction previously described. The piercing punch sleeve *L* has an integral collar and operates in the bore of collar *C*, being supported by means of three pins *I*, the lower ends of which are secured in collar *M*, and which are a sliding fit through holes in the fixed ring *J*. The collar *M* is supported upon a heavy coil spring *T* which operates through the opening in ring *E* and around the bolt on the end of which the butt end of punch *K* is assembled.

A tubular cutting punch *N* is held in perfect alignment with collar *C*, both parts having the same interior and exterior diameters. The punch on its downward stroke acting

in conjunction with the cutting die, cuts the blank *W* from which the collet is formed, and as the ram of the press continues to descend, it forces the collar *C* down against the tension of the buffer springs, carrying the blank with it and forming the collet over the reduced end of the sleeve *L*. As soon as this operation is completed, as shown at the left in Fig. 3, the flanged collar *C* becomes seated upon the collar of sleeve *L* and the continued downward movement of the punch forces sleeve *L* downward against the tension of spring *T*. A knock-out tube *O* within the tubular cutting punch has seated itself, in the meantime, upon the incompleted collet blank, and the piercing punch is in readiness to penetrate the horizontal surface of the work upon further descent of the press ram. As previously mentioned, the head of the piercing punch is spear-shaped, and the cutting edges of the spear-shaped part make the cuts in the collet, so that at the end of the stroke, as shown in the right-hand view in Fig. 3, the collet is completed.

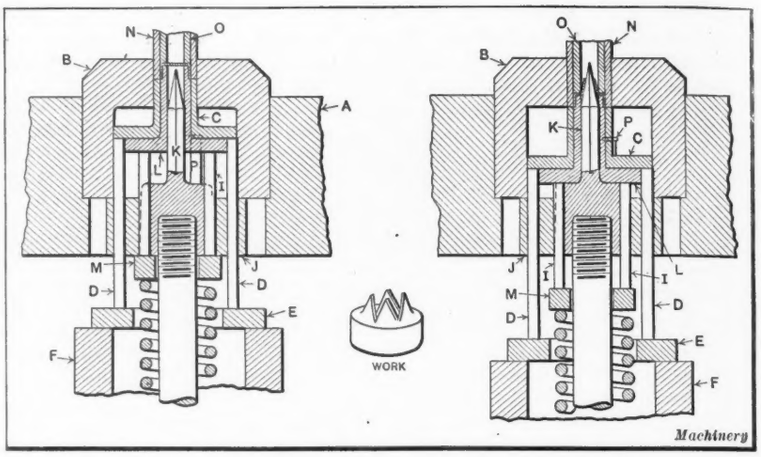



Fig. 3. Partial Sectional Views showing Position of Both Punches before and after Piercing Operation

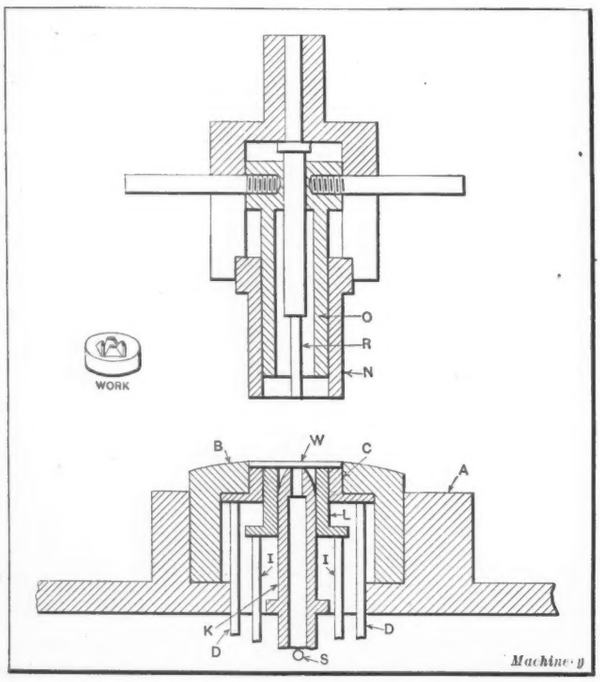



Fig. 2. Modification of Punch and Die shown in Fig. 1. The Design provides for truncating the Prongs of the Collet

The headed pin *P* is secured in the butt end of the piercing punch *K*, the head forming a stop by means of which the upward movement of the piercing punch sleeve *L* is limited when the cutting punch returns to its high position. This arrangement fixes the relation of the parts so that the operation of the flanged collar *C* upon sleeve *L* will not occur until the partially formed collet is in a fixed position on sleeve *L*, thus preventing the piercing punch from displacing the blank instead of piercing it. When the tubular cutting punch *N* has forced collar *C* below the lower edge of the collet flange, the collar is in a position to force the completed collet from the piercing punch, so that the collet will be carried upward in the tubular punch with the upward stroke of the ram, until it is knocked out by the action of the tubular knock-out *O*.

In Fig. 2 a modification of the design is shown, in which the piercing punch *K* is tubular, having a longitudinal hole extending through it, which is reduced in diameter at the cutting end of the punch. When the blank is formed by means of the cutting die *B* and the punch *N*, the knock-out tube *O* holds the blank *W* upon the sleeve *L*, and the center-punch *R*, which operates within the knock-out tube, cuts a small disk *S* from the center of the blank. The working end of the piercing punch *K* is then forced through the opening, thus cutting the prongs in the collet, the prongs having been truncated to the desired length by cutting out the disk *S*. In other respects, the operation of this punch and die is identical with the design previously described.

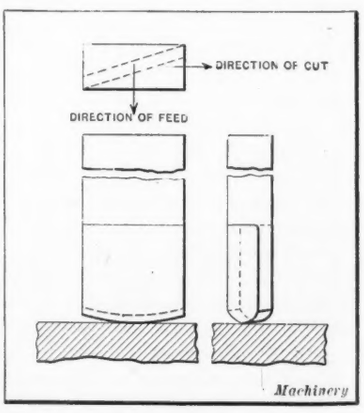
By means of the equipment here described, it is possible to form collets like those shown in Figs. 2 and 3 in a single operation. Heretofore it has been necessary to form such collets by first punching the blanks and afterward placing them in a separate punching machine for the purpose of forming the prongs—a method which was both tedious and expensive. It formerly required the services of two machines and two operators to manufacture seventy-five of these collets per day, whereas with this forming and piercing punch and die, four hundred collets per day per machine are now being produced, requiring but one operator. Thus it will be seen that a considerable saving can be effected by the use of this equipment.

* * *

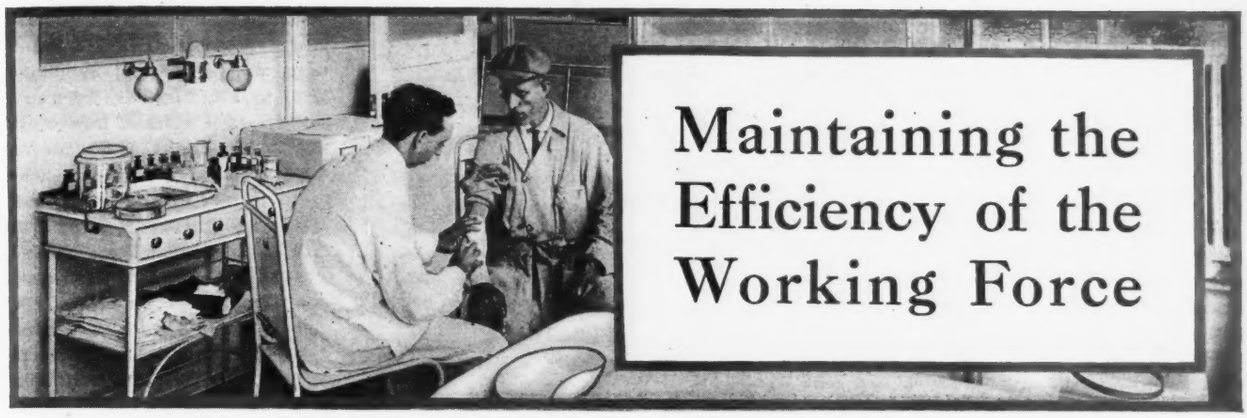
## PLANER OR SHAPER FINISHING TOOL

By S. B. ROYAL

The finishing tool shown in the accompanying illustration is used in a planer or shaper when it is desired to produce a smoothly finished surface which has the appearance of being polished. This tool is made from a bar of ⅜- by 1¼-inch tool steel, or from whatever size will fit the toolpost. Two corners of the stock are ground away for a distance of about an inch at the end of the bar leaving only a thin section, diagonally located as shown by the dotted lines in the plan view. The end is then slightly curved by grinding, allowing a clearance of about 10 degrees on the curved portion. The arrows show the direction in which the tool cuts and the direction in which it is fed across the work. Before using this tool, the work should be finished as smooth as possible with an ordinary finishing tool, leaving only about 0.002 to 0.003 inch to be removed. The work should be flooded with oil, and a medium speed and fine feed should be used. If this tool is properly ground and adjusted, it produces, when used on steel work, a peculiar twisted chip from 4 to 12 inches long which is about the diameter of an ordinary darning needle.




Finishing Tool for Use in Shapers or Planers



# Maintaining the Efficiency of the Working Force

## A Description of the Means by which the Health and Working Capacity of the Employes of a Large Machine Tool Plant are being Maintained—Based upon the Methods Employed in Welfare Work, Health Supervision, and Medical Care by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio

By ERIK OBERG

IN the article describing the system of time study and rate setting employed in the R. K. LeBlond Machine Tool Co.'s plant, published in the July number of MACHINERY, a chart was shown which gave a record of the individual efficiency of each employe. This efficiency chart was based upon the man's ability to earn a bonus in excess of his regular day rate, and included also a record of the value of work spoiled, as this, of course, is an offset or liability which must be charged against his working speed. By means of records of this kind, it is possible to ascertain how important physical health and peace of mind are in relation to efficiency in production. In numerous cases, it has been ascertained that when the curves indicating the efficiency of a man fall, there is something the matter with either his health or his state of mind; and the conclusion has been drawn that it is highly important to maintain the man in a proper mental as well as physical condition, in order that he may remain an efficient producer and thereby benefit both himself and the company for which he works. Hence, a system has been developed whereby the interests of the men in the shop are carefully looked after, as regards their health and other conditions that have a bearing upon their state of mind.

The work organized for this purpose by the R. K. LeBlond Machine Tool Co. may be divided into two classes—welfare work and health supervision—the welfare work being in charge of the welfare director, Charles H. Brown, and the health supervision in the hands of Dr. Sanford DeHart, director of the LeBlond shop hospital. These two men may be said to be in charge of the human machinery much in the same way as a superintendent of equipment would be in charge of the maintenance of the actual machinery and the mechanical facilities.

### Scope of Activities of Welfare Director

The welfare director devotes all of his time to the general welfare of the employes, both inside and outside of the plant, and it is understood that employes may come to him at any time to take up any question of importance, whether the question relate to their work or welfare in the plant, or to their individual or family life outside of the plant. The welfare director is a general advisor on every phase of human relationship. The men take up with him legal questions in which they may have been involved, family matters that they would confide to no one but him, and, briefly, anything and everything in which his advice may be of some value to them.

**A few years ago, little or no attention was paid to the relation between the output of a manufacturing plant and the health, well-being, and happiness of the workers, but a great change has taken place in this respect in recent years. Many of the leading manufacturing plants in the country have found that high efficiency and quality of output can be maintained only by a healthy and happy working force; hence, the methods used to supervise conditions of health and well-being among the workers are just as important as the mechanical devices and improvements by means of which the output can be increased in quantity and improved in quality. The R. K. LeBlond Machine Tool Co. has done some effective work along these lines, and the principal features of the system employed by this company are here dealt with.**

There are, however, six particular fields of activity to which the welfare director devotes most of his time. These are: (1) Absences from the plant, due to sickness or other causes; (2) looking after the financial interests of the men by keeping them out of the hands of loan-sharks and away from installment houses; (3) personal attention to sickness or other difficulties in the home, and to the amicable settling of family troubles; (4) the Mutual Aid Society of the plant; (5) legal aid, and advice in the buying of homes or in the making of investments; (6) aid in becoming citizens.

### Absence from Work

At nine o'clock each morning, the foremen of the different departments in the shop send a notice to the welfare director, giving the names of all the men who have been absent for three days or more, either on account of sickness or for unknown causes. In the afternoon, the welfare director makes personal calls on all of these men at their homes. If the reason for absence from work is not sickness, he makes an effort to induce the men to return to work and to attend properly to their duties. In cases of sickness, he sees that the patient is properly cared for, and, when necessary, renders such aid as may be required. During the recent influenza epidemic this aid, many a time, had to be of a purely personal character, and for that reason, the personality and the willingness of the welfare director to step in and lend a hand whenever required is of the greatest importance to the success of any work of this kind. In fact, it may be said that its success or failure depends almost entirely upon the experience, judgment, and personal characteristics of the man who occupies the position of welfare director. He must have that sympathetic attitude toward all men with whom he comes in contact that makes it possible for him to place himself in their position and to look at their problems from their point of view, as he otherwise would be unable to understand their difficulties.

### Looking after the Men's Financial Interests

Low efficiency on the part of men who have previously proved to be good workers has often

been found to be due to financial difficulties. When a man gets into the hands of loan-sharks, or is harassed by the collectors from a number of installment houses, his mind will dwell upon his troubles instead of being concentrated upon his work. It is, therefore, good business to look after the financial interests of the men and bring them into a position where they will be relieved of worries of this kind. Whenever a case of this kind is brought to his attention, the welfare director makes an investigation, and if it is found, upon doing so, that it would be to the best interest of both the man and the company to make him a loan so that he may regain his peace of mind, this is done. No interest is charged on these loans, and they are paid back by weekly installments deducted from the man's earnings. The loans ordinarily run for two months, but in exceptional instances, where the purpose of the loan and the circumstances make it advisable or necessary, they may run as long as a year. The assistance rendered in this way has a double effect. It is a temporary assistance to the man, bringing him back to his normal condition and working efficiency, and it establishes a closer relationship between the firm and the men, making it apparent to the men that the company is interested not only in their presence in the plant a certain number of hours a day, but in their general welfare as well.

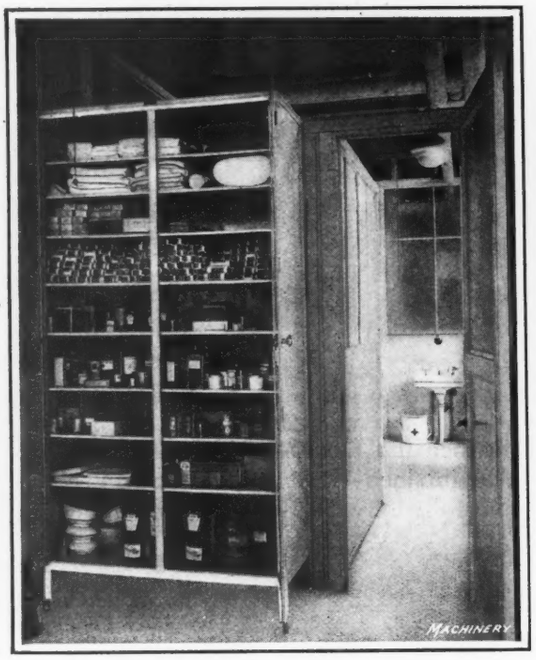



Fig. 1. Medical Supply Cabinet in Shop Hospital

### The Effect of Family Troubles on Efficiency and Output

Perhaps there is no one cause that is more effective in reducing a man's working ability than troubles and difficulties in his home. These difficulties may be due either to misunderstandings between a man and his wife, sickness in the family, worry over the actions of children, or to numerous other causes of a similar nature. In the past, it has been thought that a man had to settle these matters for himself and that they were no concern of the firm for which he worked. The experience of the LeBlond company, however, has proved that it is unquestionably of vital importance to the firm that it aid in removing these troubles and difficulties from a man's life as far as possible, and a welfare director who has the ability to understand human relationships can intercede and give aid and advice in such a manner as to save the happiness of the home. The efficiency of many a man has been restored by efforts along these lines, and, in addition, the welfare and happiness of many a family have been preserved. The wives of men working in the plant are made to understand that they can come to the welfare director with their troubles, and that they will receive sympathetic advice and aid. If the conditions surrounding a man's life outside of the plant lower his working ability, it is just as rational to try to remedy this difficulty as it is to put a machine into working order that has been injured through some unknown cause outside of working hours.

### The Mutual Aid Society

In the LeBlond plant there is a Mutual Aid Society to which the members pay 25 cents a month, or $3 a year. To this sum the company adds $1 a year for each member. The Mutual Aid Society is intended to provide a small income for the members in case of sickness, the payments from the society being $5 a week for thirteen weeks in case of sickness of one week or over, and $4 a week for thirteen additional weeks. In the case of prolonged sickness, there is no payment for the remaining six months of the year, but if at the end of one year the man is still sick, but has kept up the payment of his dues, the payment of sick benefit starts all over again on the same plan for the next year, and can be thus continued indefinitely.

The Mutual Aid Society has a visiting committee of five members who, together with the welfare director, visit sick members. In order to obtain sick benefit, the sick member must also supply a doctor's certificate. If the sickness is due to intemperance or is otherwise self-inflicted, the member is disqualified for the reception of sick benefit.

### Legal Aid

Legal aid is given to the men by a prominent lawyer, free of charge, whenever necessary. Advice is also given on questions relating to the buying of homes and in regard to investments in general. The welfare director takes pains to obtain as much information as possible relating to any subject of this kind that may be brought to his attention by an employe, and, in this way, the men are often saved disappointments and difficulties which they might have encountered if they had proceeded along lines that afterward would

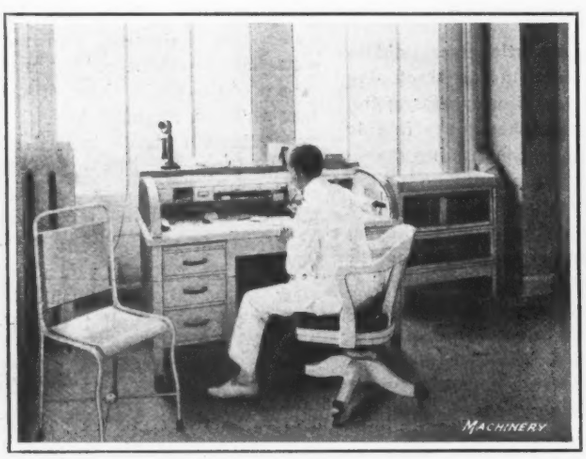



Fig. 2. Office of the Shop Physician

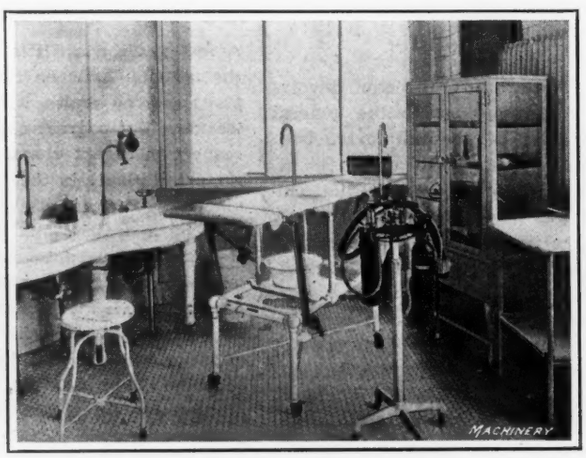



Fig. 3. Operating Room in Shop Hospital

have been found to have been to their disadvantage. The most important function of the legal department is to *keep* the men out of trouble, rather than to *get* them out.

### Aid in Becoming Citizens

The men in the plant are given entire freedom with regard to the matter of citizenship. They are advised to become citizens, but no coercion of any kind is exercised. When a foreign-born employe decides that he wishes to become a citizen, however, he is advised and aided in obtaining his papers. He is also paid for the time lost from the plant in securing the citizenship papers, and is assisted in obtaining the required witnesses to qualify him for citizenship.

Fig. 4. The Large Dining Hall in the LeBlond Plant

Serious mistakes are made by many employers in trying to force their employes into citizenship. To become a real American, a man must have voluntarily decided that he wants to become one. A man who is forced into citizenship will probably never become a good citizen, and will forever resent the coercion used in making him one; hence, no methods of this kind are employed in the LeBlond plant, but the matter of citizenship is purely a voluntary one.

### Health Supervision and Medical Care

The other important phase of the work that is done at the LeBlond plant to maintain the efficiency of the workers, is the medical care given. There is a complete hospital in the plant, in charge of a physician whose only duties and occupation are right in this plant, and who has no outside interests. The hospital is, in a sense, just as complete as a larger institution would be, except that everything is on a smaller scale. It consists, in all, of nine rooms: a waiting room, a first-aid room, a bacteriological laboratory, an operating room, an office, a dental office, a dark-room for eye work, a bedroom, and a sterilizing room.

The hospital has been organized with two aims in view: (1) To take care of both minor and more serious injuries quickly, and (2) to supervise and care for the health of the men in the shop, with a view to keeping them fit and on the job. It also serves as a means of establishing personal contact and confidence between the employer and employe, and aids in discovering any dangerous occupations, machines, or appliances in the shop which cause frequent injuries and which, therefore, must be more properly guarded. In this way, proper safety appliances may be installed, and it has been found that such appliances, together with a general regard for the welfare of the men, have materially reduced accidents and injuries. The work of the physician in charge and of Dr. M. B. Brady, a surgeon who visits the hospital one hour a day, are confined largely to first-aid matters and to a general supervision of the health of the men. Minor accidents, of course, are quite common, and the men are advised to go to the doctor with the simplest injuries, so that they may be properly disinfected and taken care of. When such measures are taken immediately, more serious results, which may cause much lost time, are prevented.

Fig. 5. Hundreds of Employes take their Lunch in the Company's Dining Hall

By having the safety appliances and the working conditions in the shop under the supervision of the physician in charge of the hospital, cooperation between the shop executives and the welfare department has been established, making it possible to reduce minor accidents to a great extent. Thus, for example, eye accidents were reduced from 5016 to 1302 per year by the introduction of proper goggles and by educating and instructing the men in their use. All men working on machines that require goggles are supplied with a safe and satisfactory kind of eye protector. No really serious accidents or infections occurred during the past year.

### Commercial Efficiency Aided by Medical Care

The hospital and its work, therefore, may be considered to be fully as much a preventive measure, as a means for taking care of injuries. It is a kind of repair shop for the human element of the plant, keeping it in condition for efficient work. When a man feels ill, he is treated at the hospital instead of going home without treatment. A record is kept of every case that has been treated, and if a man comes into the hospital often with the same complaint, an investigation is made to find out whether his trouble is organic, or whether it may be caused by the particular work on which he is employed. In the latter case, some other work, suitable to his physical condition, will be found for him, and he will be placed under medical supervision, every effort being made to cure him. Many troubles that otherwise would have gone on indefinitely and finally, perhaps, have caused serious derangements, are remedied in this way. As one example of the activities of the medical department, it may be mentioned that it was found that impurities in the cutting oil were the cause of a great many skin eruptions, and that serious infections were due to this cause. These impurities were made harmless in the cutting oil by antiseptic means, and the adverse influence on the men's physical well-being was thereby removed. There was a loss of 600

hours due to infections from oil alone, in 1917; this was reduced to 12 hours in 1918 after the hospital had introduced antiseptic measures.

### Group Insurance

The men in the plant are insured under the group insurance plan, and for this purpose a medical examination must be made. During this examination, physical defects may be discovered, and it may become evident that such defects make a man unsuited to the class of work on which he is employed. In this case, he may be transferred to some other kind of work where his defect will not be a handicap to him. The physical examination is not intended to eliminate or discard men, but merely to place them in departments where their physical ailments will not be a detriment, and where, if possible, the ailment may be cured, either by treatment in the shop hospital or by cooperation with the family physician.

Recent years have proved more conclusively than ever that the state of a man's teeth has a great deal to do with his physical condition, activity, and efficiency. This is one of the reasons why the United States Army has always insisted upon good teeth in recruits. The same reasons for insisting upon good teeth exist in industrial work, and having recognized this fact, the LeBlond plant employs a dentist for one hour a day, who comes to the hospital, examines the men's teeth, and advises them as to what ought to be done to put them in good condition. The men can then go to their own dentist to have the actual work performed. Lectures are given showing disastrous results from neglected teeth.

### General Activities along Medical Lines and Results Obtained

Twice a week, at noon, lectures on hygiene are given in the large assembly room on the third floor of the administration building, with a view to educating the men so that they may know how to care for their health properly. The physician in charge of the hospital visits the homes of men who are sick, when requested, but does not interfere in any way with the family physician to whom the men are always advised to turn for treatment, in cases when they prefer to do so.

The results obtained by installing a hospital in the shop have been gratifying. By giving the men immediate attention and treatment in cases of accidents, and by providing medical aid immediately in cases when they do not feel well, there has been less lost time, less illness, fewer infections, and, consequently, less absence from work than before this system was inaugurated. It has been conclusively demonstrated that the medical care as directed at the LeBlond plant has reduced accidents and illness and increased the efficiency and output of the factory. The activities in the prevention of accidents and disease have made it possible to avoid any serious infections during the past year. In addition, the scheme involves the elimination of all occupational diseases, and by studying the effect upon the efficiency of the workmen of such influences as lighting, ventilation, heat, and dust, it has also been possible to provide proper working conditions.

### Restaurant Service

An important feature of the welfare work is that of providing a restaurant where the men may obtain a properly cooked meal at noon. Looked upon from the point of view of mere efficiency, this is probably as important as any other activity for maintaining the human machine in proper working order. As mentioned in the general description of the LeBlond plant, in the June number of MACHINERY, the entire third floor of the administration building is devoted to this restaurant, the size and appearance of which are shown in Figs. 4 and 5. Twice a week during the noon hours, the shop band plays, and on other occasions lectures on various subjects are given, or moving pictures are shown. This diversion from the day's work makes it possible for the men to return to their occupations with an entirely different spirit from that which they have when they eat a quick lunch at the bench in the shop, and when there are no recreational features connected with the noon-hour rest.

### General Features of Welfare Work

In all welfare work, if it is to be successful, it is necessary that the welfare director command the confidence of the men in the shop. The welfare work must be directed with the double aim of benefiting the men as well as the firm, because if there should be any reason for the men to believe that the whole purpose is simply to obtain additional profits, then the aim of the welfare work would be defeated. The welfare director must be a man of the type that can definitely show to the men that they benefit directly by the welfare work. When it is understood that the best interests of the men and the best interests of the firm go together, capital and labor will come closer together and begin to cooperate for the benefit of both.

One feature that is of importance in all welfare work is that the shop man, and particularly the unskilled man, has heretofore seldom had anyone to represent him and his grievances. The welfare department is intended to take care of this condition. It establishes a link between this man and the company for which he works. When the welfare director has taken up the grievances of the unskilled and low-paid man and has won recognition for him, confidence is established in the welfare scheme throughout the plant—a confidence which cannot be shaken by any unreasonable agitator.

While the spectacular features of this work, such as hospitals, restaurants, etc., are found in many places, the greatest success is achieved only where, by direct personal interest, the welfare director can lift the burdens of the individual and prove to the men that he is a real friend. This phase of the work has no advertising value, but it has the most important bearing upon the whole relation between capital and labor, and in selecting a welfare director, it is necessary to find a man who is willing to give himself unreservedly to his work. Nor should any company take up welfare work if the officers of the company are not willing to give the welfare director unrestricted latitude in this phase of the work. Permanent results can be expected and cooperation between the men and the company obtained only when the welfare department is directed along personal lines, such as indicated in this article.

* * *

## MACHINERY SOLD SUBJECT TO SATISFACTORY PERFORMANCE

In a case decided by the District of Columbia Supreme Court, involving the right to return a piece of machinery which failed to perform the work for which it was intended in a satisfactory manner, the court laid down the following rules: When machinery is bought on condition that, if at the expiration of a specified test period it proves to be unsatisfactory it is to be returned at the seller's expense, the buyer must pay for the machine unless he gives it a fair test; but he is not bound to continue the test for the full period, if the machinery is found to be unsatisfactory in a shorter time. A test period of this kind runs from the time that the equipment is properly placed in position to do the intended work. Where no time is fixed for the return of a machine sold subject to the satisfaction of the buyer, it must be returned, or an offer must be made to return it, within a reasonable time. A request by the buyer for shipping instructions is sufficient to be considered an offer to return the machine.

* * *

China produces more antimony than any other country in the world and is the largest source of supply for the United States. A considerable amount of the Chinese exports goes to Japan for refining. An effort is being made in China to concentrate the smelting of antimony ores near the place of production.

# Advance of Thread Gage Making During the War

## Problems Confronting the Gage-maker and Suggested Solutions

By C. B. COLE

Chief Tool Inspector, Wright-Martin Aircraft Corporation, Long Island City, N. Y.

PRIOR to the war, there was only a limited knowledge of thread gages. The average manufacturer was contented with a few standard thread gages, and in many cases these were not checked at regular intervals; in fact, they were not checked at all until they became badly worn. In the fall of 1914, the British Government placed large orders for shells and other munitions in this country, specifying that the threads must conform to the Whitworth standard. For these orders, in some instances, the British Government supplied the manufacturer with standard Whitworth gages that were made in England.

### Difficulties Experienced in Cutting Satisfactory Whitworth Threads

The Whitworth thread proved to be very difficult to cut correctly. The lack of knowledge of the Whitworth thread in this country and the general antagonism to it, caused considerable trouble in producing munitions in which the various parts should be interchangeable. In order to get these badly needed munitions quickly and in large quantities, it became necessary to place orders with a great many different manufacturers for the making of various parts of the same article, and all these parts had to be held to close tolerances so that the product of one manufacturer would interchange with that of another. On ordinary parts, the problem of securing this interchangeability was not very difficult, but on threaded parts trouble was experienced. Lack of familiarity with the Whitworth thread and lack of proper gages were the chief causes. To overcome these difficulties the British Government placed large orders for gages with anyone who was competent to make them, but in a great many instances orders were placed also with companies that were not properly equipped to do this class of work.

At that time, the number of thread gage makers in this country was very small, but the wonderful adaptability of the American manufacturer and of the toolmakers and gage-makers came into play, and the manufacture of Whitworth thread gages was begun. The first attempts were often crude, but the great necessity involved and the financial inducement offered soon overcame the lack of knowledge, and very creditable gages were turned out. The trouble experienced in the beginning was in producing (1) the proper form, and (2) the proper thread tool and holder that would give a smooth finish to the thread in cutting it.

In order to cut a correct Whitworth form, it was necessary to use three different styles of tool bits, properly ground and lapped: (1) One tool had a 55-degree angle with a smaller radius on the point than was required on the thread to be cut. (2) The second tool had the correct radius on the point to finish the root diameter on a plug thread gage, or the major diameter in a ring thread gage. (3) The third tool was made with a concave end, and was produced by drilling a hole in a piece of steel at the point which was to be the front end of the tool. This hole was the approximate size of the radius wanted, or from 0.002 to 0.003 inch under size. The tool bit was then hardened and the front end ground off so that one-half the drilled hole remained. It was then lapped with a piece of music wire or spring wire to give the tool the correct radius. This tool was used to finish the crest of the thread.

By using a grinding fixture and templets, it was possible to obtain very good tools in large quantities. By the use of standard spring thread-tool holders in connection with the tool bits, and with a precision lead-screw on the lathe, it was a comparatively simple matter for a first-class lathe operator to produce thread gages that were nearly perfect before hardening. The stock used at first was tool steel; however, this proved unsatisfactory, as it was found difficult to cut a thread in the material without leaving chatter marks and it was a slow and tedious process to cut the threads. Furthermore, there was no assurance that the gages would not be spoiled in hardening, due to the effect of the heat on the steel. In order to overcome this difficulty, exhaustive experiments were made from which it was learned that ordinary cold-rolled steel was the best material to use. The blanks for thread gages were first roughed out, and then cold-water-annealed.

### Annealing and Pack-hardening

The annealing consisted of placing the blanks in an ordinary gas hardening furnace and heating them to a bright cherry red, after which they were quenched in cold water. On certain grades of cold-rolled steel or machine steel, the practice was to heat the blanks to the same color, and then quench them in lukewarm water. Then the blanks were quickly pulled out of the water before they had had time to cool thoroughly, and were placed where they would be allowed to cool slowly. Another method of annealing was to heat as previously described, then place the blanks without quenching in a cast-iron carburizing box partly filled with lime, or in a box with used carburizing material, and allow them to cool slowly. The method first described gave the best results in the majority of cases. It was then possible to cut a thread gage in about half the time it would take to cut one from tool steel. The heat-treating of the cold-rolled or machine steel blanks in the manner described overcame many of the early difficulties experienced from the expansion and contraction of tool steel after hardening.

After pack-hardening, a thread gage made of cold-rolled steel should be polished and then drawn to a dark straw color, so as to set the gage and prevent changing, and also as a means of preventing crumbling on the outside diameter or on the crest of the plug thread gage. The narrow fin left on the starting lead of a plug thread gage, especially when the gage is chamfered on the end, is very brittle, and if great care is not taken in starting the lap correctly, in spite of drawing, this fin will break off and become imbedded in the lap, thus causing a roughing or crumbling of the outside diameter. The amount of material left for lapping and grinding depends upon the pitch and upon the outside diameter of the thread gage. On thread gages, having from thirty to fifty threads per inch, and under ½ inch outside diameter, 0.001 inch is generally enough to leave for grinding. If the finish is sufficiently good, this gage will lap to size with a perfect finish.

### Laps and Lapping

The thread gage cannot be any more nearly perfect than the lap used to finish it; hence too much care cannot be taken in making the laps. The best material is a good grade of soft cast iron for medium and coarse pitches, while on a thread of very fine pitch, cold-rolled or mild steel is recommended. The use of cold-rolled steel for laps on a fine-pitch thread allows the gage to be finished with fewer laps than if cast iron were used, owing to the fact that the steel laps

do not wear as rapidly on the sharp portion of the thread. When small quantities of thread gages are to be made, it is good practice to cut the laps on the same lathe as the gages. The plug and the ring gage should always be made on the same lathe if possible. Where great quantities of gages are to be made, lathes having lead-screws that correspond should preferably be used, so if there is an error in them it can be allowed for; that is, a lathe with an error in lead on the plus side should not be used to cut a gage, and then a lathe that has an error on the minus side used to cut the lap.

A good thread gage lapper is very careful in regard to the "feel" of the laps. He will keep the lap bearing with slight pressure and not allow it to become too hot. It is generally conceded that thread gages of medium or fine pitch can be finished more economically and quickly by lapping than by grinding, provided the required number of laps is used and a good lapping compound employed. A good lapping compound can be made of a medium grade of emery and vaseline for roughing, and a fine flour emery containing a small amount of rouge for finishing. This mixture gives excellent results and will produce perfectly finished gages, provided the gages and laps are kept clean by frequently washing them in gasoline.

### Checking the Threads

When making ring thread gages to close tolerances, four hardened, ground, and lapped check plugs should be used; for example, on a U. S. standard ring thread gage that will have to be correct on all points, such as a master gage, the following plugs should be used: (1) A standard plug thread gage, dimensions to the size desired; (2) an effective diameter gage—that is, a standard plug gage ground down to the pitch line in order that it will bear only from the pitch to the root diameter; (3) a major diameter gage, having an angle of approximately 50 degrees and equal to the standard outside diameter of the thread; (4) a core or root diameter gage in the form of an ordinary cylindrical plug gage, ground and lapped to the required size.

By the use of these check gages, a thread gage maker can tell just where the error lies in a ring thread gage without the use of a lantern projector. For instance, an error in the lead of the ring gage is easily determined when a standard plug thread check will enter only half way into the ring gage from either side. The effective diameter gage also can be used to determine the error in the lead. The uses of the other gages are plainly apparent.

### Threads Having Special Characteristics

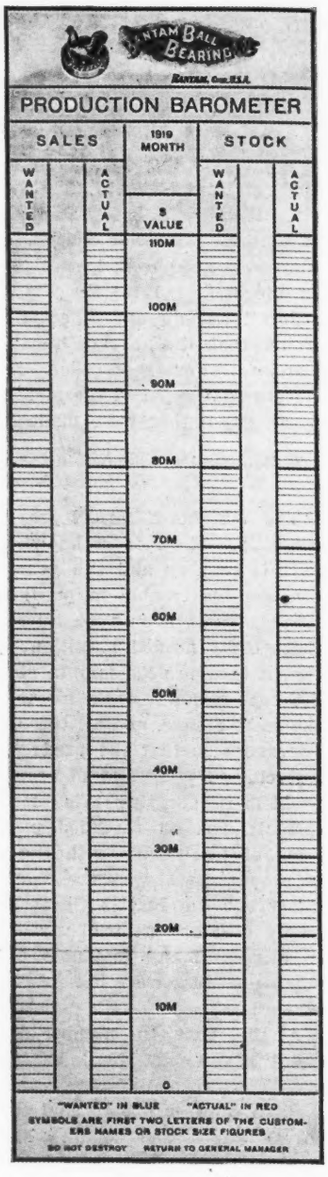
After the United States entered the war, many metric thread gages were ordered on account of the use of French equipment by the United States Government, especially in connection with the artillery. For a time a great many difficulties arose on account of using the metric system. The original drawings gave the dimensions in millimeters, and the draftsmen and toolmakers in converting these measurements into decimals of an inch did not carry out the calculations far enough. In this way, errors were made that often caused the rejection of the gage, but with the aid of charts and the careful checking of measurements, this condition was remedied later.

During the war, thread systems were used that formerly had been employed only in laboratories or in experimental work. These different thread systems presented many problems to manufacturers, executives, and foremen in jobbing and contract shops, as for instance, the Löwenherz thread with an angle of 53 degrees 8 minutes; the British Association thread with an angle of 47 degrees 30 minutes; and the French worm thread angle of 30 degrees, with a radius at top and bottom.

The thread gage problem is one that will take considerable time to solve completely. In some cases the subject is treated too seriously, while in others it is not treated seriously enough. If the progress made in producing thread gages in the last four years continues, it will be a matter of only a short time before this art will be fully mastered.

## A PRODUCTION BAROMETER

The accompanying illustration shows a form which is used by the Bantam Ball Bearing Co., Bantam, Conn., for graphically recording the sales and production in the factory. This form is known as a "production barometer." Four columns are provided, as shown, and at the beginning of the month the first column, headed "Sales, Wanted," is filled in with a blue pencil to a height corresponding to the value of orders on hand at the beginning of the month, in thousands of dollars. The third column, headed "Stock, Wanted," is also filled in with blue up to the height indicating the amount of stock that is to be made during the month. As the month proceeds the two columns, "Sales, Actual" and "Stock, Actual," are filled in with red. The "Sales, Actual" indicates the value of the orders actually filled and shipped during the month, and the "Stock, Actual" records the amount of material that has been made for stock during the month. In addition, symbols are used to indicate the amount of sales to each of the larger customers of the company.




Form used for recording Sales and Production

This barometer has been found to provide a convenient record of sales and stock orders and is used not only in the home office but is also sent to the branch offices, so that the salesmen may be kept informed about the state of the business. It shows them what orders in their territory are being worked upon for the larger customers and the value of the orders that are expected to be completed during the month. Similar "barometers" could be devised for the production in different departments in large plants and for many other purposes, both as a record and as a means of stimulating effort toward increased production.

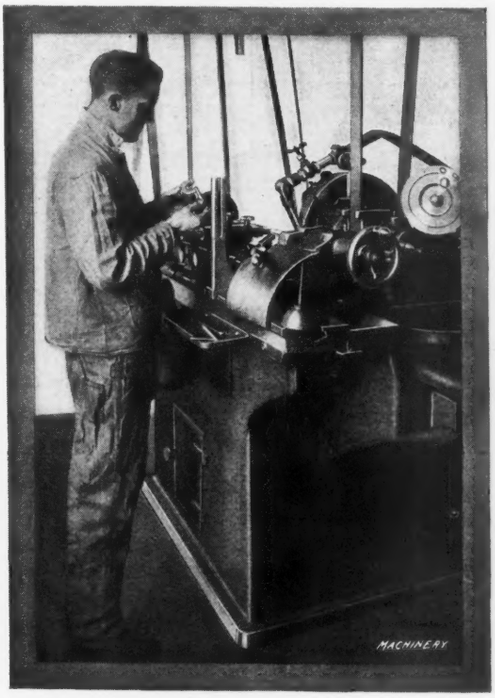
* * *

## A CLERK FOR THE SHOP SUPERINTENDENT

Very often a shop superintendent has so much clerical work to do that he has very little opportunity to get away from his desk in order to view shop conditions personally. In such a case it would be a distinct advantage for the superintendent to have a clerk who would be able to relieve him of his pen and typewriter work, and keep all statistical work, records, and graphic diagrams up to date. If a draftsman was employed in this capacity, he could also make drawings of proposed buildings, lay-outs of machinery or other work of a similar nature. This would permit the superintendent to keep in closer touch with the important needs of the various departments. S. D.

# Recording the Progress of Apprentices

EXTENSIVE apprentice courses have been instituted at the Westinghouse Electric & Mfg. Co.'s plants at East Pittsburg, Pa., for machinists, toolmakers, electricians, and draftsmen. The most interesting features of this apprentice system are the methods used for keeping records of the progress of the apprentice as regards both class work and shop work.




Briefly stated, the main features of the apprentice system are as follows: The courses in the machinist's or electrician's trades cover a period of four years, and in drafting, a period of two years. For admission to the trade courses, the applicant should be between sixteen and twenty years of age, should have a good knowledge of English and arithmetic, and should be able to solve problems requiring the use of fractions and decimals. Applicants for the electrician's course must, in addition, be able to solve simple problems by the use of algebra. Four years of high-school training or its equivalent, is required for entrance to the drafting course. The first three months of the apprentice's work constitutes a probation period, during which time the young man is studied to determine his fitness for his chosen trade; at the same time he has an opportunity to decide for himself whether or not he wishes to continue the course.

### Interviewer's Record of Applicant

When the prospective apprentice applies to the Westinghouse Electric & Mfg. Co. for enlistment in the apprentice courses, he is taken to the educational department where he is given a blank on which he answers a number of questions relating to his education and the work he has done in the past. In addition, he is asked a number of questions that have been found to give a very good insight into his general characteristics and fitness for the trade he expects to take up, such, for example, as how he spends his evenings, what books or magazines he has read during the past year, what studies he found most interesting in the public schools, what he has ever done to earn money, whether he plays baseball or football, or is interested in athletics and sports generally.

Every applicant is interviewed by two or more members of the Trades Apprentice Committee, usually the supervisor of instruction and one of the foremen. If the decision in regard to the applicant is easy to make and the interviewers agree, the interviewing stops at that point. In case of disagreement or doubt on the part of the interviewers, the applicant is turned over to one or more interviewers in addition. It scarcely ever occurs that more than three interviewers take part in deciding on any applicant.

Fig. 4 represents a chart used by interviewers for the purpose of guiding their investigations while measuring the characteristics considered desirable in applicants. The vacant spaces inside the parentheses are filled in by the interviewer with figures corresponding with the value which in his estimation should be placed upon each of the items, according to the impression he gets from the applicant during the interview. The figures printed on the chart are the maximum values for what might be considered a first-class applicant. Naturally, few of the applicants would get the maximum marks for many of these items.

**One of the weak points in many apprentice systems in the past has been the lack of a definite method of obtaining information about boys who have been accepted for the apprentice courses and of recording their progress during their apprentice term. The present article outlines the plan followed by the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., in conducting the apprentice courses in the plant so that there is an assurance that the right kind of boy is accepted for trade training, and in permanently recording the proficiency and progress of the apprentice as shown in both class and shop work.**

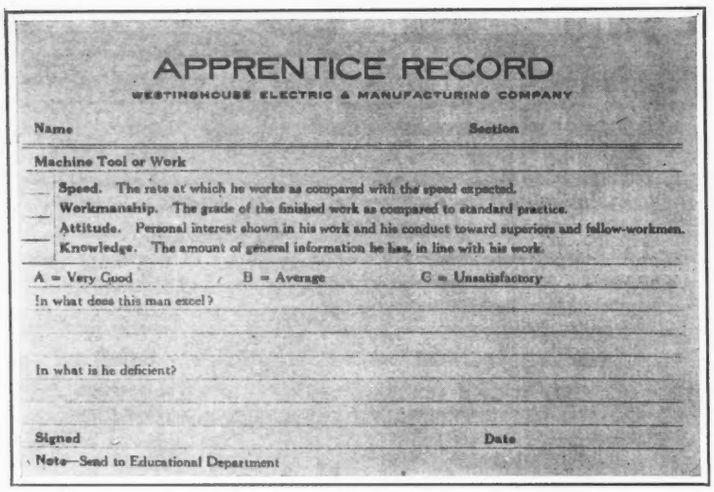
### Checking the Interviewer's Record

At the bottom of the sheet will be seen spaces denoted "Comm. check." These spaces are reserved for re-ratings which are made by the committee in charge of the apprentices, at the end of each one of the first three months of the probation period. These checks are made from reports turned in to the committee by the foreman for whom the apprentice works and from personal observation on the part of members of the committee, which consists of the director of trades training, the two foremen of apprentices, the supervisor of trades apprentice instruction and his assistant, making a committee of five in all. If at the end of the third month the apprentice is found to be satisfactory, he is accepted for regular apprenticeship and an agreement is signed with him. If he is not found satisfactory at this time he is rejected so far as the apprentice course is concerned, but is not dismissed from employment with the company; he is sent to the employment office to be considered for employment on some work for which he may be fitted. Of course, there may be instances when an apprentice is dismissed at this time, if he is found unsuitable for any work in the plant.

A blank such as shown in Fig. 2 is sent out in cases where inquiry regarding applicants is made by mail. These are generally sent to school principals, business men, former employers, and others whose names the applicant may furnish as references. The persons to whom these blanks are sent are asked to check the applicant in regard to the characteristics with which he is familiar. When these are returned, they are placed on file with the individual's application, for use in selection when the applicant lives at a distance and a personal interview is not possible.

### Reports from the Shop and the Class Room Showing Progress of Apprentice

The foremen in the various sections employing apprentices, including the section specifically devoted to apprentice training, report to the Trades Apprentice Committee on blanks prepared for the purpose. The characteris-



APPRENTICE RECORD

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

Name Section

Machine Tool or Work

Speed. The rate at which he works as compared with the speed expected.
Workmanship. The grade of the finished work as compared to standard practice.
Attitude. Personal interest shown in his work and his conduct toward superiors and fellow-workmen.
Knowledge. The amount of general information he has, in line with his work.

A = Very Good B = Average C = Unsatisfactory

In what does this man excel?

In what is he deficient?

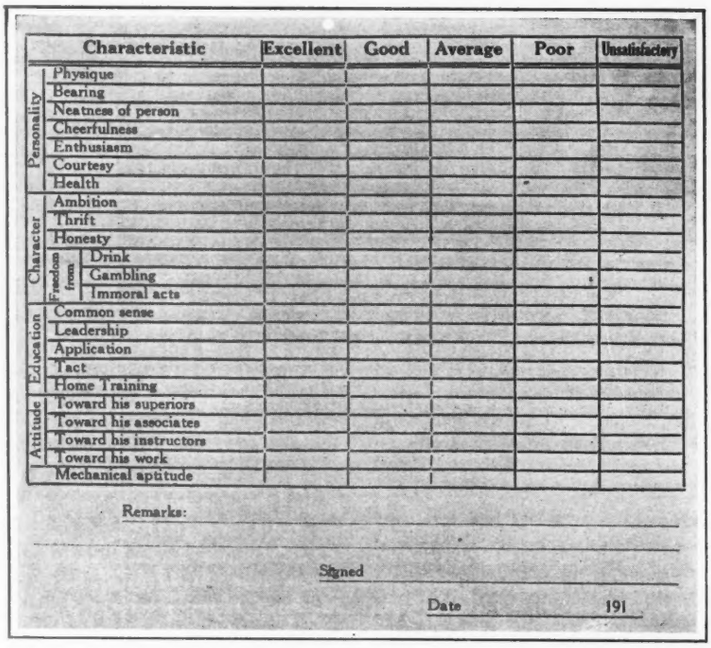
Signed Date

Note—Send to Educational Department

Fig. 1. Record of Apprentices made out by Foremen

tics considered in these reports are speed, workmanship, attitude, and knowledge; and the various degrees of proficiency are indicated by A (Very Good), B (Average), and C (Unsatisfactory). The form on which the apprentice's shop standing is recorded is indicated in Fig. 1.

Class-room instructors also report to the committee the progress of the apprentice in shop problems and in mechanical drawing. They report their judgment of the apprentice in regard to a number of characteristics concerning which it is considered desirable to have information. The form on which this report is made and the characteristics on which the apprentice is graded are shown in Fig. 3. Such qualities as speed, neatness, accuracy, etc., are indicated by numbers from 1 to 5 inclusive, while the records of examinations, class work, home work, etc., are given in percentages.



| | Characteristic | Excellent | Good | Average | Poor | Unsatisfactory |
|---|---|---|---|---|---|---|
| Personality | Physique | | | | | |
| | Bearing | | | | | |
| | Neatness of person | | | | | |
| | Cheerfulness | | | | | |
| | Enthusiasm | | | | | |
| | Courtesy | | | | | |
| | Health | | | | | |
| Character | Ambition | | | | | |
| | Thrift | | | | | |
| | Honesty | | | | | |
| | Freedom from: Drink | | | | | |
| | Gambling | | | | | |
| | Immoral acts | | | | | |
| Education | Common sense | | | | | |
| | Leadership | | | | | |
| | Application | | | | | |
| | Tact | | | | | |
| | Home Training | | | | | |
| Attitude | Toward his superiors | | | | | |
| | Toward his associates | | | | | |
| | Toward his instructors | | | | | |
| | Toward his work | | | | | |
| | Mechanical aptitude | | | | | |

Remarks:

Signed

Date 191

Fig. 2. Form used for obtaining Information about Applicant by Mail

The information thus obtained is combined in a complete apprentice record which is kept in the educational department and from which the committee determines, in the first place, the rating, as indicated in Fig. 4, during the first three months, in order to determine whether or not the regular apprentice contract should be signed, and later, the rating or marking for the apprentice during his course which may entitle him to certain special advancement.

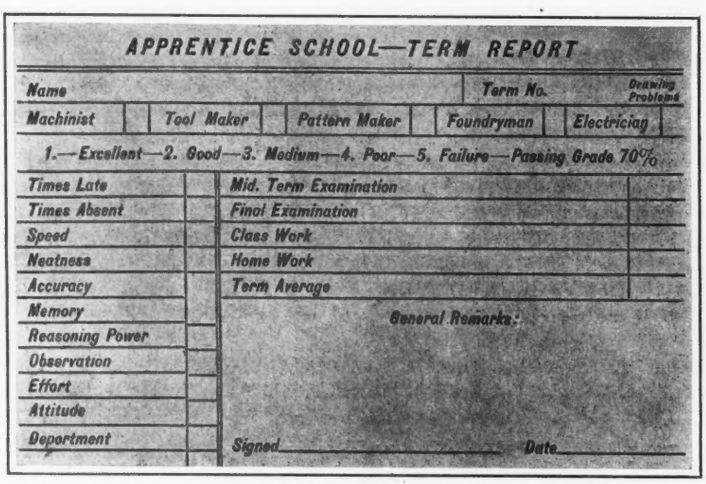
### Use Made of Records Obtained

The committee meets once a week and at each meeting the records of all apprentices who have finished eleven months of the apprentice year are brought to the attention of the members. The committee examines the records and grades the apprentices into four classes—A, B, C, and D. If an apprentice is placed in Class A, one month is taken from his apprentice course, or in other words, he is permitted to begin immediately on his next year. If an apprentice should be graded as a Class A man at the end of each eleven months during the four-year apprenticeship, he would save one month each year and would finish his apprentice course four months ahead of schedule. If he finishes his course as a Class A man he will be accorded a higher rate as journeyman than he would if he finishes as a Class B or Class C man. At the present time, the rate per hour for Class A men is 3 cents higher than the rate for Class B men, and the rate for Class C men, 3 cents lower than the rate for Class B men. If the apprentice is placed in Class B, he will be required to serve his normal time. This class includes the majority of the apprentices. If he is placed in Class C, he is notified that he must show an improvement, and if he should be so deficient that he is placed in Class D, he is either discharged or sent to the employment department for suitable work.

The system also includes a class attendance record which is kept by the instructor and on which is marked absence and lateness at each lesson. A record is also kept in the class room of the accuracy with which the apprentice solves his shop problems, so that everything that has a bearing upon his work, ability, and personality is properly recorded, and nothing is left to snap judgment.

In this way it has proved possible to grade apprentices accurately, and to promote and to give to each a just reward for his efforts. Compared with the more or less haphazard methods in apprentice instruction that have been employed in the past, the system offers such a great improvement that it is well worth studying. It will undoubtedly be of suggestive value to other manufacturers who conduct apprentice courses, and may be applied either wholly or in part, according to the requirements in each individual plant.

E. O.



APPRENTICE SCHOOL—TERM REPORT

Name Term No. Drawing Problems

Machinist | Tool Maker | Pattern Maker | Foundryman | Electrician

1.—Excellent—2. Good—3. Medium—4. Poor—5. Failure—Passing Grade 70%

| | | | |
|---|---|---|---|
| Times Late | | Mid. Term Examination | |
| Times Absent | | Final Examination | |
| Speed | | Class Work | |
| Neatness | | Home Work | |
| Accuracy | | Term Average | |
| Memory | | General Remarks: | |
| Reasoning Power | | | |
| Observation | | | |
| Effort | | | |
| Attitude | | | |
| Department | | | |

Signed Date

Fig. 3. Apprentice Class-room Record

## ECONOMY OF THE NIGHT SHIFT

By STUART DEAN

Shop superintendents are often discouraged with the results obtained from the night force. Much of the work turned out must be done over again, and machines, fixtures, and cutters receive much more severe usage than when used by the day force. This is due, to a large extent, to the fact that the night force is often composed of inexperienced men who do not have as much supervision as the men on the day shift. Furthermore, the wages of the night shift are generally about one-fourth greater than the wages paid to the day force.

In order to eliminate the night force and at the same time maintain production, it is necessary to purchase more machinery and put up new buildings, provided, of course, that the present buildings are filled to their maximum capacity. If the following figures are noted, it can easily be decided whether it is more economical to maintain the night force or to purchase additional machines and erect new buildings.

New buildings cost at least $3.25 per square foot—this figure covering the designing work on the building, the cost of the land, and the cost of the building, including the contractors' and architects' charges. This first cost should earn 5 per cent on the investment, for it would ordinarily earn that rate at least if invested in some other way. Another 5 per cent margin must be allowed for wear and tear or depreciation, cost of lighting, heating, cleaning, insurance, watchman and all the other expenses that are necessary to keep the building in condition. This makes a constant item of 10 per cent or 32.5 cents each year on every square foot of floor space. To this must be added the cost of new machinery. A turret lathe purchased recently cost $3000; it occupies possibly 100 square feet, and taking this rate as an average, $30 per square foot must be added to the $3.25 per square foot building cost, making a total cost per square foot of $33.25. At a rate of 10 per cent for depreciation and interest on the investment, this represents a yearly expense of $3.33 per square foot in the machine department.

It is evident that with a night force this item is eliminated. Another point in favor of the night shift is that it brings quicker results than erecting new buildings and purchasing machinery, as a firm that employs a night shift can immediately take care of all ordinary sudden increases in business.

* * *

The Norwegian parliament, by an almost unanimous vote, has recently appointed a committee of employers and representatives of labor, with a few independent experts, to consider the advantages of co-partnership as a means of securing industrial peace.

WEIGHT CHART FOR SELECTION OF TRADES APPRENTICES

| | | WEIGHT | | | |
|---|---|---|---|---|---|
| MENTAL | | | | | |
| (a) | Two-year high school at 16 | 5 | ( ) | | |
| (b) | Observation | 5 | ( ) | | |
| (c) | General knowledge | 5 | ( ) | | |
| (d) | Attitude | 5 | ( ) | | |
| (e) | Self reliance | 5 | ( ) | | |
| | Total | 25 | | | ( ) |
| MORAL | | | | | |
| (a) | Manners and habits | 5 | ( ) | | |
| (b) | Character | 10 | ( ) | | |
| | Total | 15 | | | ( ) |
| PHYSICAL | | | | | |
| (a) | Appearance | 5 | ( ) | | |
| (b) | Activity | 5 | ( ) | | |
| (c) | Health | 10 | ( ) | | |
| | Total | 20 | | | ( ) |
| GENERAL IMPRESSION | | | | | |
| (a) | Tact | 5 | ( ) | | |
| (b) | Common sense | 10 | ( ) | | |
| (c) | Mechanical aptitude | 5 | ( ) | | |
| (d) | Future ambitions | 5 | ( ) | | |
| | Total | 25 | | | ( ) |
| MATHEMATICS | | 10 | ( ) | | |
| REFERENCE | | 5 | ( ) | | |
| | Total | 15 | | | ( ) |
| | GRAND TOTAL | 100% | | | ( ) |

APPLICANT..... DATE.....

COURSE..... INTERVIEWER.....

ACCEPTED..... 1. COMM. CHECK.....

REPORTED..... 2. COMM. CHECK.....

3. COMM. CHECK.....

AGREEMENT SIGNED.....

Fig. 4. Interviewer's Record of Apprentices

## LIABILITY OF EMPLOYERS DURING STRIKES

By CHESLA C. SHERLOCK

While the employment of outside help during a strike is generally deemed inadvisable as a matter of policy and because of the usual violence which it brings about, it is not the purpose of this discussion to enter into that question at all, but rather to treat of the employer's liability for the injury or death of a man temporarily employed, where such a person has been injured or killed because of his relation to the employer. The courts never would have expressed themselves upon the matter if it had not been brought to a head by the unfortunate and often disastrous results of the struggle between labor and capital. Lives have been lost in this way. Passing up the employer's liability in such cases is no different from passing up his liability in other cases where workmen meet with accidental injury or death.

### Cases Illustrating Employer's Liability

In a New York case, an employer engaged a certain workman during a strike, and in the contract of employment agreed to protect the workman from all loss, injury, damage or liability, because of the character of his employment. In the course of a few days, the striking workmen succeeded in meeting this man alone and in the ensuing struggle and fight, they killed him. It was a plain case of violence such as is enacted in every industrial center from time to time. The dependents of the dead man naturally produced the contract of employment and contended that the employer was liable for the death of the deceased and that he should stand the damages. The employer refused, with the result that the matter was taken to the highest court in the state. This court carefully considered the circumstances from the beginning, not losing sight of the apparently broad guarantee which the employer had held out to the workman as an incentive for him to accept the work. The court held that the right of an action for the death of a human being does not rest in the common law, no provision for such an action having been made in the common law practice, and that if there were any right of action in such a case it would depend upon statutory law. The court went further and said, as a second premise, that the right to recover for the death of a human being depends entirely upon the statute of the state in which the death occurs.

Before going further it might be well to consider just what such a limitation as this means. It narrows the ground upon which the plaintiff can stand, to the wording of a statute granting, in express terms, the relief sought. If there is nothing in the common law that will afford the plaintiff aid or support, then the ground upon which he has to stand is very slim indeed.

Going further, the court examined the statutes of New York and came to the conclusion that the employer could not be held in this case for the death of the man. In New York there is a statute which permits action to be brought against employers for death caused by the employers' negligence; but the court said that as the employer was free from negligence in this case, the dependents could not recover.

Some people may say that this is not a good decision, but they should keep in mind a fact which is oftentimes forgotten when contracts of employment are drawn up between workmen and their prospective employers, that is, that every statute which can in any way apply to that employment, or which has been enacted to throw light upon the relations between the employer and his workmen in that particular employment, is construed by the courts to be a part of the contract of employment. In this case, the contract of employment, read in the light of the statute, would say that the employer agreed to hold the workman free from loss, injury, or liability caused by the employer's negligence.

### Concealing the Fact that there is Labor Trouble

In Colorado, a unique case came up, which illustrates sound legal principle. It was shown that a man was employed as a stoker in the employer's power plant and that, at the time of employment, the employer knew there was a strike in progress in his plant. Knowing this fact, the employer hired the stoker without telling him the situation, or in any way acquainting him with the danger he was taking in assuming the position. The evidence further disclosed the fact that the striking workmen had threatened violence to anyone taking up the employer's work, a fact which the employer knew at the time he hired the stoker, but which he concealed.

The stoker continued at work for several days, still unacquainted with the true state of affairs, and while engaged in his work was fired upon by the strikers. As a result, he was incapacitated for some time, suffered severe injury and pain, and lost a great deal of time from his trade. The lower court was disposed to dismiss the case on a technicality, but the supreme court held that if the employer, at the time the contract of employment was entered into, knew of facts which would increase the normal risks and hazards of the employment, he was legally bound to impart this knowledge to the other party to the contract, and that as he had failed to do so, there was sufficient ground to place the liability for subsequent damage upon the employer.

While it may be said that few workmen could be employed in a place lately vacated by strikers, and continue in that employment for several days without ascertaining the true condition of affairs, this does not, in any respect, alter the employer's general liability and duty. It is the duty of the employer to impart to the prospective employe all knowledge which he has of any special risks or extra hazards concerning the work that the employe is about to do. If the employer fails to do this, whether it be in the case of a strike or not, the damages will be assessed to him.

### Opposite Ruling in a Similar Case

In a Kentucky case, a man had been employed at a time when he did not know that there was a strike in progress in the employer's establishment. The employer had not told him the true condition of affairs. A few days later some of the strikers came to the man and served notice upon him that they would not permit him to continue at work. The workman then communicated the threat to his employer, the latter promising to provide the workman with a guard to protect his person. This the employer failed to do, with the result that the strikers waited until the man had gone to his home; then they attacked him and beat him so badly that he died. The dead man's relatives brought an action against the employer for damages, alleging that he had failed to perform the terms of his agreement, that is, to provide a guard, and also had failed to advise the deceased of the strike at the time the latter had entered his employment.

The court stated that it was not the duty of any employer to protect his workmen from the criminal acts of another, and that there was nothing in the Kentucky statute or constitution granting to persons the right to bring an action for the death of a human being resulting from negligence or from the wrongful act of another. Here, again, we find the right of action hinging upon statute, there being nothing in common law to sustain the cause. And since there was no statute, even though it was implied that the employer might have been liable had there been one, the employer was relieved from all liability.

### Recovery under Compensation Acts

Recovery under the compensation acts is based entirely upon the manner in which the injury was received. It must be the result of an accident arising out of, and in the course of, the employment. If the injury was not received under these conditions, no recovery can be had, no matter how seriously the workman was hurt. The only case which seems to have been reported involving the compensation acts in connection with a strike, arose in the English courts. There it was decided that an injury to an employe during a strike was not an accident and that it did not arise out of the employment. This decision, of course, implies some things which we did not find in some of the cases already mentioned, so it does not remove altogether the possibility of a man's recovering compensation under a different state of affairs.

It implies that the man knew that there was a strike in progress at the time he entered upon the employment and that his injury arose at a time and under circumstances which were not connected with the employment. It is generally known that if a workman is injured while he is on his way to or from his place of employment, he cannot recover compensation. So, if a man during a strike is injured in this manner, he cannot recover compensation, either; but the situation might be altered somewhat if the injury were done in the manner of the one in the Colorado case previously mentioned.

* * *

## CUTTING STEEL BY THE USE OF ACID

By D. E. MAPES

The writer recently had occasion to make a disk of 0.006-inch spring steel having a U-shaped slot in the center. The slot was 1 1/16 inch wide and, due to the hardness of the metal, it was impossible to drill holes and finish the slot by filing. It was also impracticable to use a chisel for forming the disk, because it had to be entirely free from burrs.

A description of the use of etching fluids in machine shops, which was published in a previous number of MACHINERY, prompted the idea of endeavoring to cut the disk and slot by means of acid. Blue vitriol was applied to the sheet of steel and faint outlines of the circle and slot were drawn. A very light coating of wax was then applied, and the outlines of the slot and circle were traced carefully through the wax, after which the acid was applied, and it was learned that by agitating the acid it seemed to cut faster. It was found advisable to apply the wax to both sides of the steel in order to prevent the acid from spreading after the steel was cut through. The results of doing the job in this manner were very satisfactory.

* * *

The Bureau of Standards recommends the use of a small quantity of calcium chloride in the mixing water of concrete in order to hasten the hardening of the concrete. Tests showed that the addition of calcium chloride to the mixing water up to 10 per cent by weight increases the strength from 30 to 100 per cent over that of concrete in which plain water is used, and that the best results are obtained when from 4 to 6 per cent of calcium chloride is used. While calcium chloride has no harmful effect upon the concrete, it does affect iron and steel, and therefore should not be used for reinforced concrete.

# Universal Sine Bar for the Toolmaker

## Method of Making, and Application to Various Classes of Precision Work

By J. B. GRAY, Foreman of Tool-room, International Motor Co., Plainfield, N. J.

THE question as to whether or not it is fair to check a man's work with Johansson gage-blocks when he is not permitted to use these standards of accuracy, suggests many similar questions that may be raised in connection with the methods sometimes employed in tool-room work. For instance, if a toolmaker must depend upon the ordinary methods of setting his work according to the machine graduations, which are not usually accurate enough for gage-making requirements, is it right to "check him up" with the sine bar in the inspection room? Why should gage-makers spend two days lapping flat work that could be done in four hours at the longest, if the work were properly machined to close limits in the first place? These and many similar questions were considered in the tool-room of the International Motor Co.'s plant, Plainfield, N. J. Existing methods were questioned, and the more they were studied the more evident it became that improved scientific methods should be introduced to meet the advanced demand for accuracy and production. With this idea in mind, a number of precision tools were made for use in the tool-room, the most important of which is the sine bar.

### Undesirable Features of Regular Sine Bar for Average Tool-room Work

The usual type of sine bar fixture seemed to be too heavy and cumbersome for general tool-room work, as it is intended for use only in the inspection room. Its bulk, weight, and cost are too great for tool-room work, and the difficulty of using it, unless complicated mathematical calculations are employed, makes it undesirable for general use by the average toolmaker. Consequently, the toolmaker has neither the opportunity nor the inclination to use the big sine bar.

The smaller sine bars that are on the market are not found in most tool chests, probably owing to the fact that they require extra apparatus to be used for ordinary tool-room work. At least two or three parallel blocks, four C-clamps, and one or two angle-plates will be needed. Since no toolmaker can carry all this equipment in his tool chest, and as it is generally more or less difficult to find these auxiliary tools when wanted, the inclination on the part of the toolmaker seems to be to set up his work according to the machine graduations and to trust to their accuracy and his judgment in setting the machines carefully. This method is, of course, unsatisfactory when extreme accuracy is required.

### Special Requirements of Tool-room Sine Bar

What seemed to be required in the tool-room was a small, accurate sine bar fixture that every toolmaker could keep, and, what is more important, one that he would be able to use. To meet these requirements, several conditions should be considered: First, the bar must be simplified in design and in the method of its use, without sacrificing its accuracy or its universal features. A bar that must be clamped to an angle-plate or that must be set on a surface plate was found undesirable, because the adjusting with a vernier height gage on a surface plate, or the clamping to an angle-plate allowed too much leeway for the occurrence of errors, and also consumed too much time. Second, the bar must be so designed that any toolmaker can set it at once without surface plates, angle-plates, clamps, or vernier height gages; and third—above all else—it must eliminate the chance of error.

### Description of Special Sine Bar

The concrete result of the tool department's investigations is shown in Fig. 1. This is a 4-inch sine bar, the centers of the two buttons being 4 inches apart. All the equipment

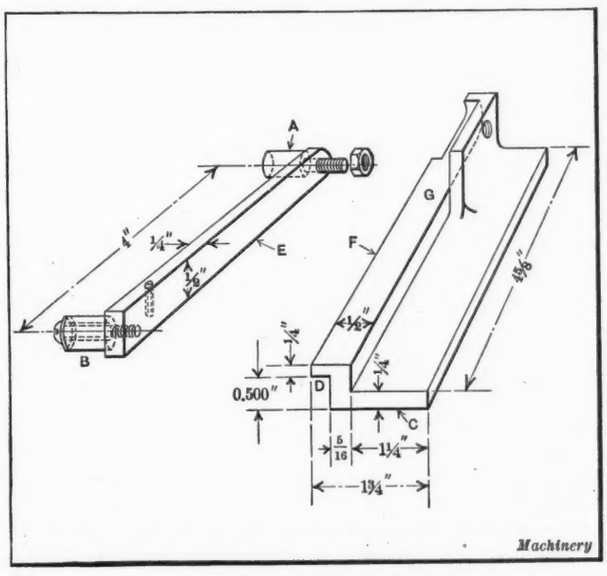



Fig. 1. Universal Sine Bar for Toolmakers

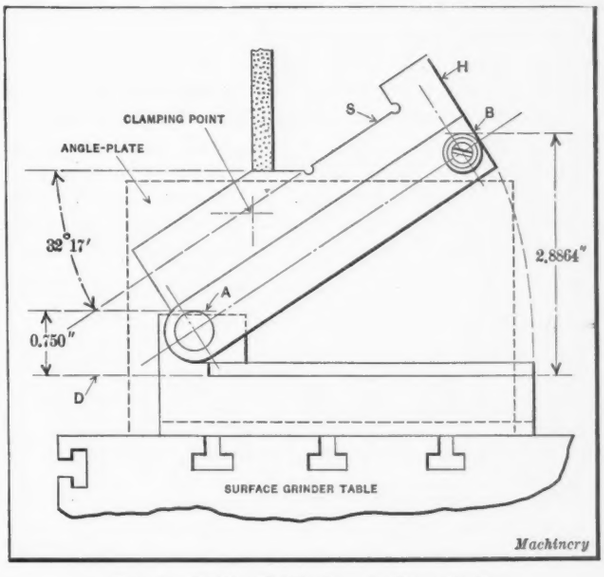



Fig. 2. Grinding Profile Gage to Given Angle

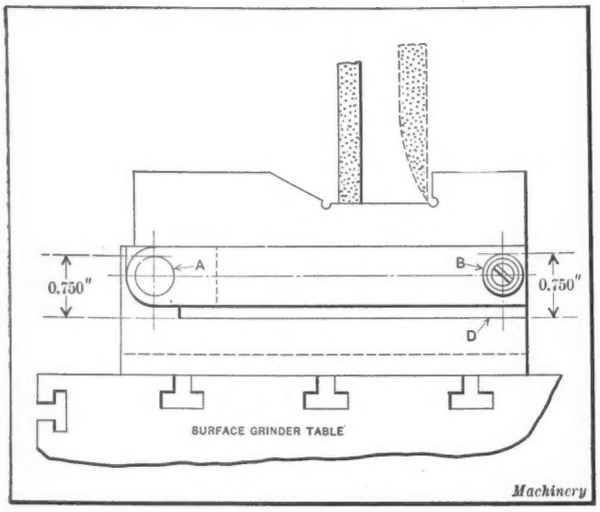



Fig. 3. Sine Bar used as a Parallel

needed when using this sine bar is a pair of ordinary micrometers. Before explaining how the tool is used and pointing out its universal features, a word about its design and construction may perhaps be desirable.

Referring to the illustration, the first thing that will attract attention is the movable button *B*. There are two good reasons for not having a fixed button at this point; in the first place, the question of cost in making the sine bar must be considered. It is a much more economical process to drill and tap a hole approximately four inches from the center of the fixed button *A* than it is to drill and tap it exactly four inches from the center of the button, which would be necessary if a fixed button were used at *B*. The movable button can be located exactly by the use of 4- to 5-inch micrometers, and can be held securely by the screw, as illustrated. Any movement of this button can be instantly detected, because, when the bar is closed as shown in Fig. 3, the measurement *over* the button *B* to the *under* side of the aligning ledge at *D* should be 0.750 inch to correspond with the position of the fixed button *A*, and this dimension can, of course, be tested with a micrometer.

The second reason for having button *B* movable is to permit of any adjustment that may be found necessary to compensate for inaccuracies caused by temperature changes —that is, for elongation or contraction—because of the constantly varying conditions which affect the temperature in all shops. Considerable latitude may be allowed as to diameter of buttons, except of course that the diameters must both be the same. The constant dimension, which in this particular case is 0.750 inch, may be made to any other measurement that is desired.

### How the Sine Bar is Made

The bar *E* and the base *F* should be made of machine steel, pack-hardened; the screw is casehardened machine steel; and the two buttons may be made of low-grade machine steel, which will be found satisfactory when pack-hardened, ground, and lapped. If preferred, drill rod may be used for the buttons provided it is left soft. The buttons should be ground and lapped to size, 0.400 inch being a convenient diameter; next surface-grind *G;* then grind surface *D* until the dimension 0.750 inch to the top of the stationary button *A* is obtained; then grind the lower or under surface of the base at *C* until the distance from *C* to the upper side of *A* measures 1.250 inch; finally set the buttons, and the fixture is finished. The reason for having the dimension from *D* to *C* 0.500 inch is to have this a standard gage-block distance, in order to permit of the use of Johansson blocks in connection with the sine bar, should this be desirable. With the foregoing data and the few principal dimensions given in the illustration, anyone capable of using a sine bar should be competent to make one.

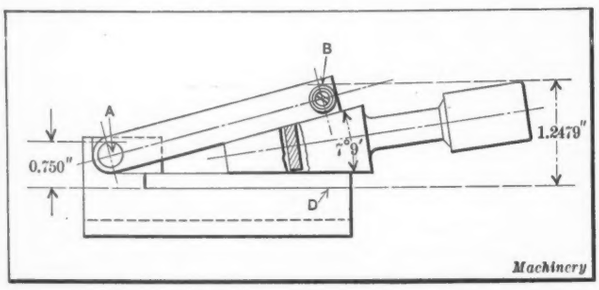



Fig. 4. Sine Bar used in checking Angle of Gage

### Application of Sine Bar to Various Classes of Work

This style of sine bar is extremely accurate for laying out, machining, grinding, lapping, and inspecting gages of different types, as well as plugs, rings, and flat gages of different tapers. It is also adapted for such work as planing, milling and shaping tools, jigs, and special work requiring extreme accuracy. It may also be used to lay out, bore, and face jigs, and other angular and straight work to within very close limits; to test dividing heads for accuracy in spacing; and for many similar classes of work. As the various illustrations are dealt with, each piece will be described and an explanation given as to just why it was considered desirable to test it with the sine bar.

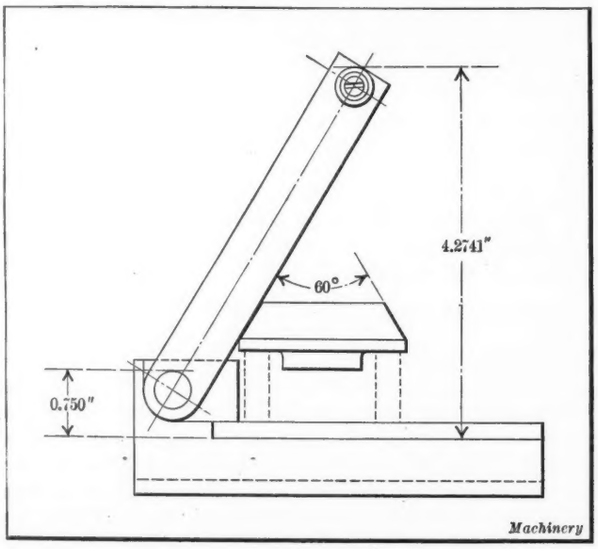



Fig. 5. Checking Angle of Valve

Fig. 2 shows a flat gage *H*, used for gaging cone bearings. Here the vital point is the relation of the angular gaging surface to the surface *S*, which must be accurately ground to form the required angle. The sine bar is first set at the required angle, using a 3-inch micrometer, and the angular portion of the gage is ground as shown. The sine bar is then closed, forming an accurate parallel on which the gage is allowed to rest. A cut may next be taken over surface *S*, with the assurance that it will be at an angle of 32 degrees 17 minutes with the previously ground surface. This permits grinding close to size, with only a small allowance for lapping, as there will be no error in angularity to correct. Fig. 3 shows the final setting of this gage on the surface grinder. In setting the sine bar, the measurement over the movable button only is taken, the measurement over the fixed button being always 0.750 inch.

Fig. 4 shows a tapered spline gage, the included angle (7 degrees 9 minutes) of which is being tested for accuracy. Absolute accuracy is not required, and if the gage will "shut out light" when in the sine bar, it will pass inspection satisfactorily. This gage, like the preceding one, is ground on the surface grinder and set up by means of the sine bar; it will therefore closely approach absolute accuracy. Fig. 5 shows part of a valve that is being turned out in quantities. The

forming tool for this job was made by an outside firm and is difficult to check up accurately on account of the angle. The piece, because of the boss on the under side, had to be mounted on the ground collar shown in dotted lines. In this way it was possible to check the work and the forming tool before starting to machine a large number of pieces.

Fig. 6 shows a small drill jig set up on the drilling machine table preparatory to drilling the two bushing holes in the bosses *C* and *D*. The bosses are to be counterbored ¾ inch deep to receive drill and reamer slip bushings for the ⅜-inch holes. The bosses must also be faced off to seat the heads of these bushings properly. This illustration also shows one of the few instances in which the use of a height gage is required in connection with the sine bar. The sine bar is used for setting the angle-plate at 60 degrees with the surface of the machine table. As shown in Fig. 6, two angle-plates are used, one being bolted to the machine table as a support for the other, which is clamped in position on the supporting angle-plate at the required angle. The angle-plates should be true, and unless they are, the planed base of the jig itself might as well be used to serve as a gaging surface.

Fig. 7 shows a milling job on a guide plate for a profiling jig. In this case, the piece *A* is bolted to the table and a light surfacing cut is taken over the side, and with this surface as a base, the jig is set to 17 degrees 5 minutes, as shown. An end-mill is used in a vertical attachment for performing the milling operation.

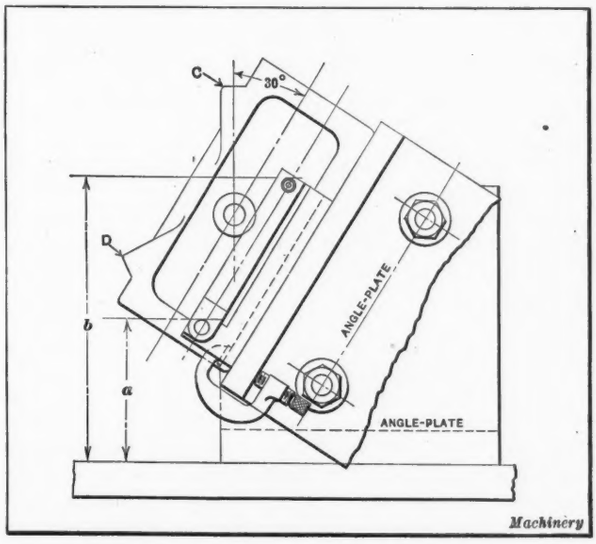



Fig. 6. Using Sine Bar for drilling Holes at Given Angle in Drill Jig

Fig. 8 shows the sine bar as a gage for use in accurately grinding thread tools to the Acme standard. There are many ways to grind tools for U. S. standard and V-thread forms, but the Acme thread is one for which an accurate gaging method is usually lacking.

### Use of Sine Bar in Checking Accuracy of Index-head

Sometimes it is desirable to check up machine tools and their equipment, and in this connection the sine bar can usually be of service; for example, there are occasions when it is desirable to check the accuracy of an index-head. To do this, it is necessary only to place a piece of stock between the centers, take a straight slabbing cut, revolve the index-crank one complete turn, and then take another straight cut. This piece is then taken to the bench; one of these surfaces is clamped to a true angle-plate, and the other surface is tested for angularity, which will be 9 degrees when a 40-tooth worm-wheel is used on the index-head as is usual. The method is a good test for the accuracy of the dividing head.

### Convenience in Setting Sine Bar

The length of the sine bar here described (4 inches) has been chosen because that seems to be a convenient size both

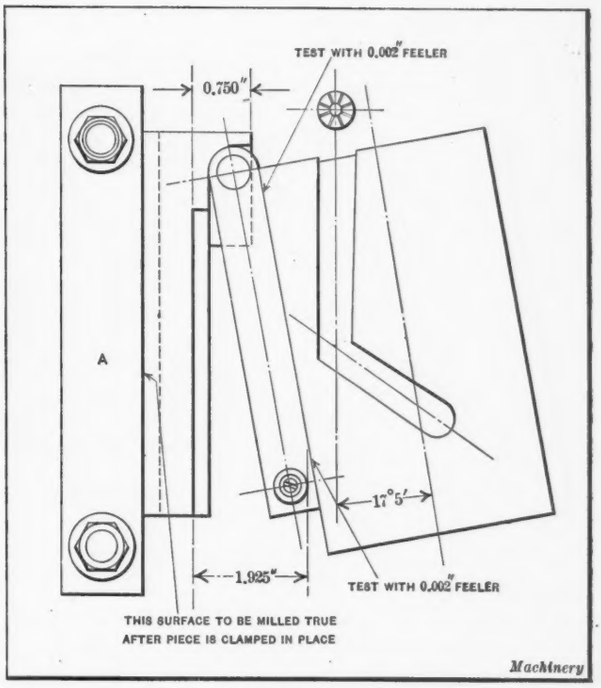



Fig. 7. Milling Guide Plate for Profiling Jig

to make and to keep in the tool chest. The figure 4 is also a very convenient number to use in connection with the table of sines and cosines. It is assumed that every toolmaker and machinist has a working knowledge of the sine table; but the sine bar is an instrument of precision, and because this fact is sometimes overlooked it may be well to give a few examples showing how the sine bar is set with an ordinary micrometer. It should be stated that the idea in giving the examples and presenting the accompanying illustrations is not to show how any particular job should be done, but to emphasize the importance of the sine bar method, as applied to everyday work. To this end, typical examples have been selected, covering a wide range of work. It will be found that what is true of the application of the sine bar to the simple work shown in the accompanying illustration is equally true of all work, however complex.

### Examples Showing Use of Sine Bar

For the benefit of those who may not be familiar with the method of using a sine bar, the following explanation will be given: In Fig. 2 is shown a common flat gage, the two surfaces of which are at an angle of 32 degrees 17 minutes to each other. Referring to a sine table, the sine of 32 degrees 17 minutes is found to be 0.53411, and since the distance from center to center of the sine bar buttons is 4 inches, multiplying sine 0.53411 by 4 will give 2.13644 inches,

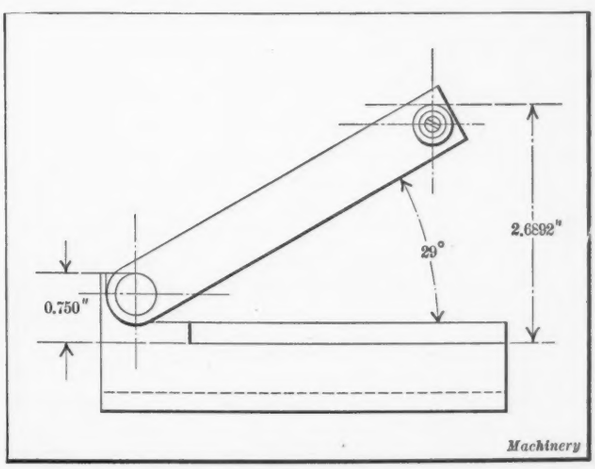



Fig. 8. The Sine Bar used as a Gage for grinding Thread Tools for Acme Thread

which is the amount that the button *B* must be higher than the fixed button *A;* but since button *A* is 0.750 inch from the measuring surface *D*, 0.750 inch must be added to 2.13644 inches, making 2.8864 inches. Now with a 3-inch micrometer, the top of button *B* is located 2.8864 inches above the surface *D*, Fig. 1, and after the lock-nut has been tightened, the bar is ready for use, either as a gage or as an inclined parallel, so to speak.

If it is required to check a dimension, it may be desirable to use the sine bar as a gage. Suppose it is required to determine the angle of the spline gage shown in Fig. 4. After setting the sine bar to the gage, as shown, a 2-inch micrometer is used to obtain the measurement from *D* to the top surface of *B;* the result is 1.2479 inch, from which 0.750 inch is subtracted. This gives the distance from the top surface of *A* to the top surface of *B;* then this difference in height (0.49788 inch) is divided by the distance between the centers of buttons *A* and *B*, that is, by 4 inches. The result is 0.12447 which, by referring to the sine table, is found to be the sine of 7 degrees 9 minutes; therefore, the spline gage has an included angle of 7 degrees 9 minutes.

* * *

## COMBINATION BLANKING AND SHAVING DIE

For the use of one of its customers who is engaged in the manufacture of adjustable wrenches, the Nelson Tool Co., Inc., 781-783 E. 142nd St., New York City, designed and made a combination blanking and shaving die which is here illustrated and described. The bodies of these adjustable wrenches are blanked out from strip metal, the width of which is equal to that of the nose of the finished wrench. The strips of stock are fed through the die along the heel-block *D*, Fig. 1. The blanks are prevented from tilting during the operation of the punch by means of a pad which is supported by heavy springs and which is located under the die opening. As the stock is fed through the die, the blanks shown by the full lines in Fig. 2 are stamped out and deposited in a box. The irregular piece of excess stock is afterward placed in the die and the blanks shown by dotted lines are stamped therefrom, each piece being handled separately. It will be evident that by this arrangement the amount of unnecessary or scrap material is reduced to a minimum.

It will be seen from Fig. 1 that the die used for performing these operations is of a rather simple design. Previous experience in stamping out these wrench bodies had shown that it was impossible to make blanks which were sufficiently smooth around all the edges so that they did not require a subsequent operation to produce a good finish. Formerly, it was the practice to obtain this finish by milling, but the Nelson Tool Co. suggested making this combination die which would first blank out the parts and then provide for shaving them down to a smooth surface by a second operation. This result is obtained by having the blanking die made in sections. It is unnecessary to shave the wrench

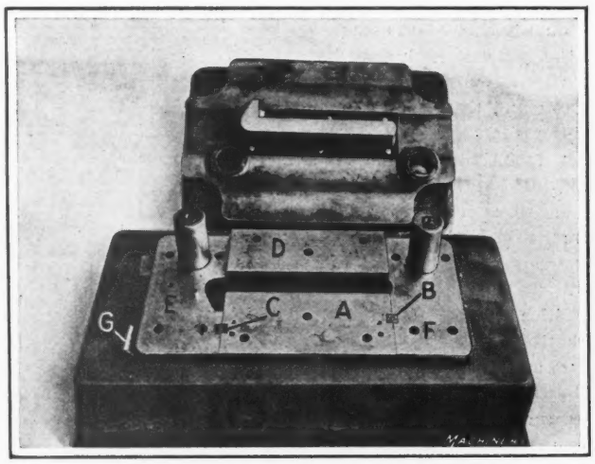



Fig. 1. Combination Blanking and Shaving Die

body blanks along the edge which lies adjacent to the heel-block while the bodies are being blanked out. Provision for shaving the opposite edge, as well as the end and the nose of the blank, is made by having the location of section *A*, and of the end blocks *E* and *F*, adjustable. Block *A* may be adjusted for narrowing the die opening by means of two offset pins *B* and *C*. The end blocks may be adjusted by transferring the two shims which are used in the blanking operation from between the movable blocks to the ends of the blocks, as shown at *G*. The thickness of these shims, as well as the amount of adjustment of block *A*, is 0.005 inch, which furnishes a sufficient amount of stock to be shaved off in the final operation. This method of finishing the edges gives the desired results, and the cost of doing the work in the die is much less than it would be if a milling machine were used for the purpose. Obviously, this combination die is also the means of saving a large part of the expense of making a second die for performing the shaving operation.

* * *

## THE DESTRUCTION OF IRON AND STEEL WORKS IN NORTHERN FRANCE

In a report to the director of the Bureau of Mines, Frank H. Probert, consulting engineer of the Bureau of Mines, Department of the Interior, who has made an investigation of the damage done by the Germans during the war to the coal and iron industries in France and Belgium, points out how the Germans, upon retiring from the occupied territory, systematically destroyed the plants in this area. Newspaper reports to this effect have, of course, been current, but an engineering investigation giving complete details is now at hand. No greater atrocity has ever been perpetrated against the industrial life of any country. Magnificent plants, comparing favorably with the best in the United States, are now a tangled, twisted mass of structural steel and broken stone. The willful mutilation was scientifically planned and systematically carried out, after all mechanical and electrical machinery that could be used in Germany had been removed.

In addition, the cities in the French coal mining region which a few years ago were the mainspring of the industrial life of France are gone as a result of the fighting in the sectors that frequently changed hands during the war and that were frequently under bombardment. The Germans in their forced retreat destroyed the steel linings of the mine shafts by dynamiting them, letting in quicksand and flooding the underground workings for many miles. In the Pas de Calais region, it is estimated that 120,000,000 cubic meters of water must be pumped before mining operations can be resumed. After the mines were flooded, the head frames and surface equipment were systematically dynamited and, in many instances, the twisted debris fills up the demolished shafts. It is estimated that it will be five years before this coal district can be rehabilitated, and from twelve to fifteen years before it will come back to its normal pre-war output.

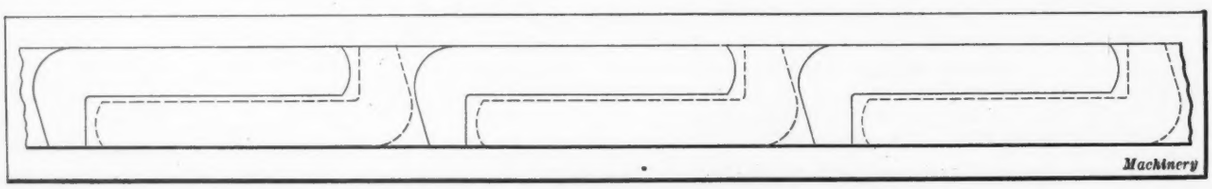



Fig. 2. Diagram showing how Blanks are cut out with the Minimum Waste of Stock

# The Manufacture of Malleable Iron

By HENRY A. JOHNSON

ALTHOUGH the use of malleable iron or, more strictly speaking, malleable cast iron for machined parts has increased to an enormous degree within the last ten years, very little is known of its manufacture outside of the malleable foundries themselves. Details of this material have remained more or less a trade secret, and for this reason, perhaps, the opinion is prevalent that this material is a product resulting from the heat-treatment of ordinary cast iron. Both being cast metals, the foundry processes are similar but this is the extent of their similarity.

The reason for the increased use of this iron is obvious. Good malleable iron has physical properties resembling those of wrought iron, and as it is primarily a cast metal, odd shapes, housings, etc., may be made which possess, to a marked degree, the properties of forged metal. The tensile strength of malleable iron is much higher than that of cast iron, and being ductile it offers considerable resistance to sudden shocks and strains. The standardizing of this material as regards chemical analysis makes it possible to obtain a uniform and dependable product at a cost slightly above that of gray cast iron.

Unfortunately this material possesses all the inherent defects of a cast metal, namely, blow-holes, sand spots, slag spots, mis-runs, shrinkage, etc., thereby limiting its use, where absolute dependability of structure is essential. Another feature limiting the use of malleable iron is the fact that the malleableizing process is ineffective at much over an inch in depth, and hence malleable castings are seldom greater than this thickness in section. Physically speaking, malleable iron is the ductile tough product resulting from the prolonged heat-treatment of white, hard, and brittle iron castings. The prolonged heat-treatment is known as annealing. From a chemical standpoint, malleable iron is an iron in which the carbon has been changed from the combined state to the free state by the annealing process.

### Chemical Properties

As the production of malleable iron is a chemical process, it may be well to discuss briefly the chemistry involved. The properties of any ferrous metal depend upon the quantities and condition of the carbon content. In white cast iron the carbon has combined chemically with some of the iron, forming iron carbide, which remains in solution in the rest of the iron like sugar in water. Iron carbide is extremely hard, and hence white cast iron is very hard and unworkable. Iron carbide being white, accounts for the color of the fracture of the so-called "white iron." If such an iron is given prolonged exposure to a temperature somewhat below the melting point, the iron carbide will slowly come out of solution and be broken up by the heat into free black carbon. This free carbon will exist in the iron like sand in water, and a fracture after this treatment will show a dull black surface due to its presence. The exposure to heat in this manner is the theory of the annealing process, and if all of the iron carbide is broken up, the iron will be found to be ductile and to resemble wrought iron.

There are two definite steps in manufacturing malleable iron—the casting and the annealing. It is essential to establish a definite length of time for the annealing, and as the time required to remove all the carbide varies greatly with the chemical content of the iron, it is necessary to hold to very close chemical limits in the melting furnaces. It becomes, then, the duty of the melter to figure his melt so that a white iron of known composition will result. Sulphur and manganese are the two elements which affect the annealing operation. To anneal iron in a reasonable time commercially, sulphur must be kept below 0.10 per cent and manganese must be about three times this amount. The effect of manganese is to neutralize the sulphur, but if manganese runs much above 0.40 per cent, a tough, hard machining iron will result. Two other elements of importance are carbon and silicon. These elements, while not affecting the annealing, control the tensile strength of the product. A low percentage of carbon will give a high tensile strength, and vice versa. With a low percentage of carbon, however, a high percentage of silicon must be used to obtain a good flowing metal at the furnace, but as the effect of silicon is to prevent the carbon from uniting with the iron to form iron carbide, there is at once imposed a limit as regards the minimum percentage of carbon.

It is quite possible to manufacture malleable iron having a tensile strength of 50,000 to 60,000 pounds per square inch and an elongation of from 12 to 16 per cent in two inches. A feature of malleable iron that should not be overlooked is the fact that the higher the tensile strength, the greater is the elongation. This is characteristic of malleable iron and is in contrast with practically all other metals. Owing to the impossibility of keeping the sulphur content as low as 0.10 per cent with a cupola furnace, air reverberatory or open-hearth furnaces are used for melting. These furnaces melt the iron in amounts of from ten to twenty-five tons at a time, and should the analysis, which is always made just before the furnace is tapped, show a wrong composition, ferro-silicon or ferro-manganese can be added and the charge puddled to obtain a correct iron. A melt in a ten-ton furnace will take about eight hours, and two melts per day are usual with this size furnace. White iron, when cast, shrinks twice as much as gray iron, or ¼ inch to the foot, and much difficulty is encountered with shrinkage cracks, especially if large cores are used. Cores for malleable work must be porous and reasonably soft, in order to give sufficiently as the iron cools around them.

### Inspecting before Annealing

After the castings are cleaned by rolling or tumbling, they are sent to the inspection room, which is a very important part of all malleable shops. Three methods of inspection are used—visual, gaging, and sound. The use of gages is generally confined to determining wall thickness and correctness of form. The hammer or sound test is relied on, to a great extent, to determine the soundness of the casting. An unsound casting will at once be detected by the dull flat ring given out when struck with a hammer, but if a sound casting is struck with a hammer it will give a prolonged ring. An annealed casting when tested will give off a short ring. This test is universally relied upon in the shop to determine the condition of any piece.

The location of the inspection room between the foundry and the annealing department serves a twofold purpose: first, it prevents further work on material which would ultimately be scrapped; second, as 90 per cent of the total scrap of a malleable shop is from the foundry, it returns hard iron of a known composition for remelt. After annealing, the composition is not definitely known, and for this reason malleable scrap has a lower value for remelting.

### Annealing the Castings—Malleableizing

From the inspection room the good castings are carried to the annealing house for treatment, and at this operation the similarity with gray iron foundry practice ends. The

annealing house, or room, is usually rectangular in shape with a row of annealing ovens extending along one of the sides. These ovens are of brick, square in section, and large and high enough for a person to walk about in them. In the further corner, as seen from the room, is a firepot, opening at the top into the oven proper, so that the products of combustion circulate about the oven before going up the chimney. The hard or soft coal fire, as desired, is regulated from the back end, and the front or room end is provided with large doors through which the oven is loaded. The castings to be annealed are packed or embedded in rolling mill scale in iron pots, which are normally open at the top and bottom. It is customary to arrange these pots three high. This done, a steam or air truck picks up the set and places it in the cold oven. In sets of three high the oven is filled to capacity, the doors are closed and sealed with fireclay, and the fire is started. The iron annealing pots are about 18 inches wide, 24 inches long, and 15 inches high, and will last from six to ten heats apiece. The purpose of the scale is to keep the fire from touching the articles. It was formerly thought that rolling mill scale had some beneficial action on the annealing process, and although this material is now generally used, sand packs have produced equally good malleable iron.

Iron carbide begins to come out of solution at about 1350 degrees F., but the action is too slow at this temperature to be of use commercially. At a temperature of between 1500 and 1700 degrees F., however, the action is more rapid. With this temperature in mind, and with the chemical limits fixed as mentioned before, a standard time for treatment has been adopted. This standard time is to bring the temperature up to between 1400 and 1700 degrees F. as soon as possible, maintain it there for forty-eight hours, then let the fire go out and the oven cool slowly for four days. As it ordinarily takes two days to get the heat up, the whole process requires eight days from the time the fires are started until the castings are removed. It is essential that the oven be cooled very slowly from its high temperature, and indeed this is a determining factor in the quality of the product. Iron behaves like water; even when solid its ability to hold substances in solution increases with the temperature. At temperatures of from 1400 to 1700 degrees F., not all of the carbide will come out of solution. At 1300 degrees F., however, it will all come out of solution, and if the temperature is held near that point sufficiently long, all the remaining carbide will be broken up into carbon. The quality of malleable iron depends on breaking up all this carbide, and hence slow cooling from the 1400-degree point to about 1200 degrees F. is absolutely essential. One of the largest malleable firms in the country, after exhaustive research on this point, has determined that during this period it is unsafe to cool at a rate exceeding 6 degrees per hour. This point is not generally known, and accounts for much of the poor malleable iron produced.

There are two changes that take place in the casting itself during the annealing. The casting loses carbon which is absorbed by the packing, and gains sulphur from the packing and from the coal used. As the amount of this change cannot be determined, the melter hesitates to use large amounts of malleable scrap for the furnace charges. During the annealing, castings swell ⅛ inch to the foot, thereby recovering one-half of the shrinkage at casting. After the castings have cooled and the pots are broken down they are rolled, or better, sand-blasted and given a general inspection, after which they are ready to ship.

ANALYSIS OF AND RESULTS OF TESTS ON MALLEABLE IRON

The standard test bar is a ⅝-inch cast bar

| Carbon, Per Cent | Silicon, Per Cent | Sulphur, Per Cent | Manganese, Per Cent | Tensile Strength, Pounds per Square Inch | Elongation, Per Cent in 2 Inches |
|---|---|---|---|---|---|
| 2.97 | 0.80 | 0.053 | 0.31 | 44,720 | 6.0 |
| 2.82 | 0.65 | 0.055 | 0.24 | 46,870 | 8.5 |
| 2.65 | 0.57 | 0.066 | 0.21 | 51,530 | 10.0 |
| 2.60 | 0.62 | 0.065 | 0.24 | 54,335 | 14.5 |
| 2.47 | 0.83 | 0.057 | 0.29 | 47,790 | 9.5 |
| 3.10 | 0.81 | 0.071 | 0.25 | 34,070 | 3.5 |
| 2.98 | 0.91 | 0.074 | 0.33 | 41,690 | 4.5 |
| 2.80 | 0.74 | 0.048 | 0.27 | 49,087 | 9.0 |

*Machinery*

### Chemical Analysis

The ordinary limits for chemical analysis for the white iron castings are: Carbon, 2.30 to 3.20 per cent; silicon, 1.08 to 0.50 per cent; sulphur, not to exceed 0.010 per cent; and manganese, from 2.5 to 3.5 times the sulphur content.

Owing to the importance of the analysis, the more reliable malleable iron firms maintain a research department, with well equipped chemical and physical laboratories, under the direct charge of a research man. Temperature recording instruments for the annealing ovens are under this man's control, and a record of the physical and chemical characteristics of every melt made is kept on file for future reference. The results given in the accompanying table are taken directly from the reports of different malleable foundries and represent regular commercial heats made from day to day.

### Cupola Bessemer Electric Process

Mention should be made of a new process of melting for white iron, which is coming into use at this time. This is the so-called "cupola Bessemer electric process," and takes into consideration the small cost of cupola melting. Briefly, the iron is melted in the ordinary cupola, blown in a Bessemer converter to obtain the proper analysis, and reheated in an electric furnace preparatory to casting. This system can be used to advantage in a large plant having a central melting room, and while the grade of malleable iron produced is excellent, it does not appear that this method will supersede the use of the reverberatory furnace except in the largest plants. Machine shops handling cupola Bessemer electric malleable iron find that it is more even in texture than the air furnace product, and that it contains fewer hard spots. The writer believes this to be due to the fact that only the most reliable foundries are using this process, and indeed he has been unable to discover any difference in machining properties in the two types of malleable iron, when made by the same firm.

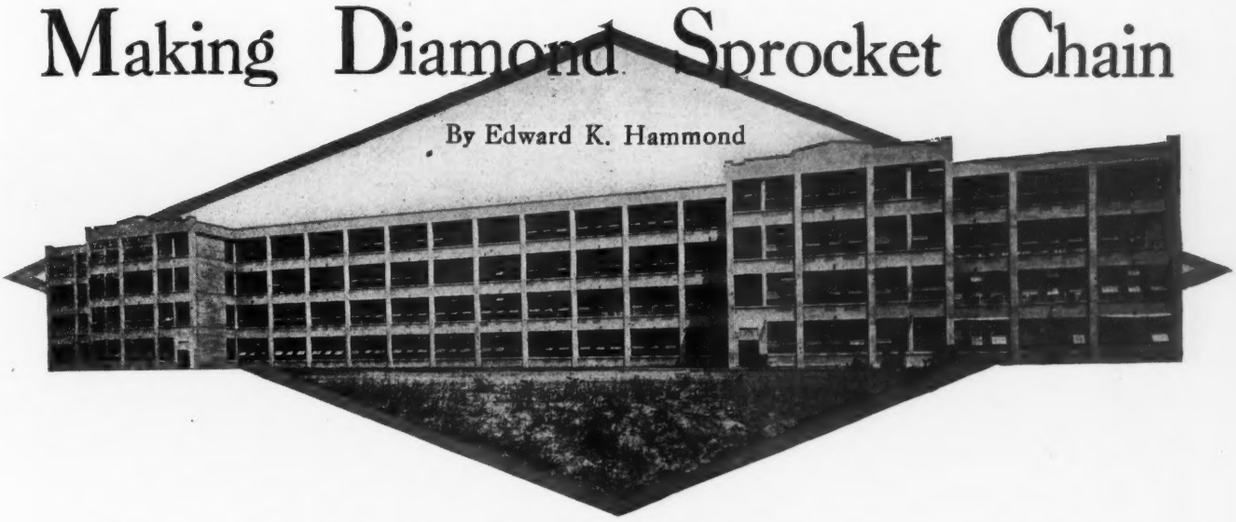
* * *

## ALUMINUM SOLDER

Solders and methods of soldering aluminum recently have formed the basis for an investigation by the Bureau of Standards. It is stated that all metals used for aluminum soldering are electrolytically negative to aluminum. A soldered joint for this reason is attacked by electrolysis and destroyed when exposed to moisture. Hence it is recommended, unless repairs are heavy, as in the case of large castings, that the soldered joint be protected by paint or varnish. Solders should be applied without a flux after preliminary cleaning and tinning of the surfaces to be joined. The solder should consist of a tin base with an addition of zinc, or zinc and aluminum. The function of the alloys is principally to produce a fluid mixture within the range of soldering temperatures. A high temperature is advised to secure adhesion of the tinned surface. For tin-zinc solders, the following composition is suggested: Zinc, 15 to 50 per cent, and the remainder tin. For tin-zinc-aluminum solders, the composition suggested is: Zinc, 8 to 15 per cent; aluminum, 5 to 12 per cent; and the remainder tin. By using the higher values of the zinc and aluminum percentages, the solder will be too stiff at the lower temperatures to flow readily. A higher temperature will secure a better joint. Good aluminum solder should not be brittle. The tensile strength of the better grades of aluminum solder is about 7000 pounds per square inch. The strength of the joint, however, is dependent upon the workmanship.

# Making Diamond Sprocket Chain

By Edward K. Hammond



## First of Two Articles Describing Special Machines and Fixtures Developed for Making Sprocket Chain

ONE hundred and sixty-eight different styles and sizes of sprocket chains are made at the plant of the Diamond Chain & Mfg. Co., Indianapolis, Ind., so that it would obviously be impractical to attempt presenting anything in the nature of a comprehensive review of this firm's manufacturing practice. But in this industry, which has been steadily growing since the early days when bicycle riding became popular, a number of extremely interesting and ingenious special machines and fixtures have been developed for use in making parts of sprocket chain. These would always be of interest to readers of MACHINERY, but at present the publication of a description is especially timely owing to the fact that the Diamond Chain & Mfg. Co. has recently moved its plant into the new steel and reinforced concrete buildings shown in the heading illustration.

### Brief Description of the New Plant

Before starting a description of sprocket chain manufacture, it will be of interest to briefly review the facilities which are provided in the new Diamond plant and to explain the way in which various departments have been distributed. There is a main building four stories in height, which is of steel and reinforced concrete construction and measures 460 by 60 feet. In addition, there is a one-story building placed beside the company's private siding from the Pennsylvania Railroad. This smaller building is 80 feet wide by 300 feet long, and is occupied by the receiving and shipping departments, by space for the storage of raw material, and by the heat-treating department. There is also a co-operative store in this building, in which employes of the company can buy groceries, meats, and certain forms of clothing at cost prices. In the main part of the factory, the space has been utilized as follows: The first floor is occupied by general offices, by space for the storage of finished chain parts, and by the punch-press department. On the second floor there are the factory offices, the maintenance department, and the milling and drilling departments. The third floor is occupied by offices of the welfare and employment departments, by a cafeteria restaurant for the factory employes and by the automatic screw machine department. On the fourth floor all of the space is given over to the work of assembling and inspecting the finished chains.

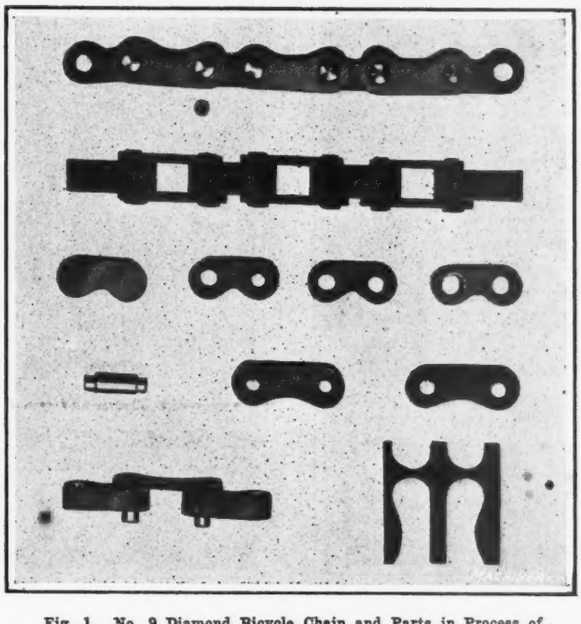


Fig. 1. No. 9 Diamond Bicycle Chain and Parts in Process of Manufacture

### Standards Adopted for Sprocket Chain

At the annual meeting of the American Society of Mechanical Engineers held in New York City in December, 1917, a meeting was arranged between the chain standards committees of this society and of the Society of Automotive Engineers, to adopt standard sizes for sprocket chain. Representatives of chain manufacturers were also present at this joint session, and the result was that standard sizes, designated by numbers, were adopted with the view of reducing the number of different sizes in which sprocket chains are made, and also of standardizing these sizes so that any maker's chain of a specified size would run on the same sprocket wheels. For the sake of discussion, in this article it has been decided to select the No. 8 "manufacturers' standard" chain which is the 2-inch pitch chain used on motor trucks where this type of drive is employed; and the No. 9 sprocket chain which is the size commonly used on bicycles. Attention will first be given to the operations involved in making the bicycle chain.

### Making Sprocket Chain for Bicycles

In starting to describe the operations which are involved in making bicycle chain, attention is first directed to Fig. 1 which shows two short strands of the chain in different positions, and also parts of the chain in process of manufacture. From this illustration, it will be apparent that the No. 9 bicycle chain consists of three essential parts, namely, the side plates, the center blocks, and the rivets which hold the two preceding parts together. In

Fig. 2. General View of Storage Space provided for carrying Various Kinds of Steel used in making Sprocket Chain

the following some of the more interesting operations and the machines on which these operations are performed will be described.

### Cutting off Center Blocks from Bar Stock

The center blocks for bicycle chain are made from steel bars which have been rolled to a section resembling a capital letter *B*. Blanks are cut off from bars of this shape on milling machines which are equipped with a number of saws carried on a single arbor, to provide for cutting off a considerable number of blanks at a single operation. As shown in Fig. 3, the machine is equipped with a fixture having multiple jaws which hold all of the blanks after they have been cut off until the jaws are released, after which these blanks drop through a chute into a receiver which is placed in position to catch them. This chute and receiver will be seen at the left-hand side of the machine. Special attention is directed to the fact that Diamond sprocket chain is used to transmit power from the countershaft to the main driving shaft on the machine and also to the feed-box. It is stated that the application of this positive chain drive was the means of increasing production obtained on this operation by at least 20 per cent.

### Drilling Rivet Holes in Center Blocks

Another interesting operation involved in the production of center blocks for bicycle chain consists of the drilling of rivet holes, which is done on special machines of the type shown in Fig. 4. These machines were built in their original form by the firm of Norton & Jones, but in order to adapt them for this peculiar class of drilling, the original single-spindle drilling machines have been greatly modified in design and a number of interesting special fixtures and attachments have been added. The blanks to be drilled are fed to the work-holding fixture on the machine by means of a feed-chute *A*. There are two holes to be drilled in each blank, and as there is only a single drill *B* for the performance of this operation, it will be apparent that each piece must be shifted once in order to locate it in the proper position for drilling the two holes. The feeding of each successive blank to the machine and indexing the work for drilling the second hole are automatically controlled by means of a simple cam mechanism; and after the finished work has been drilled, it is automatically ejected and another blank placed in the fixture ready for the following operation.

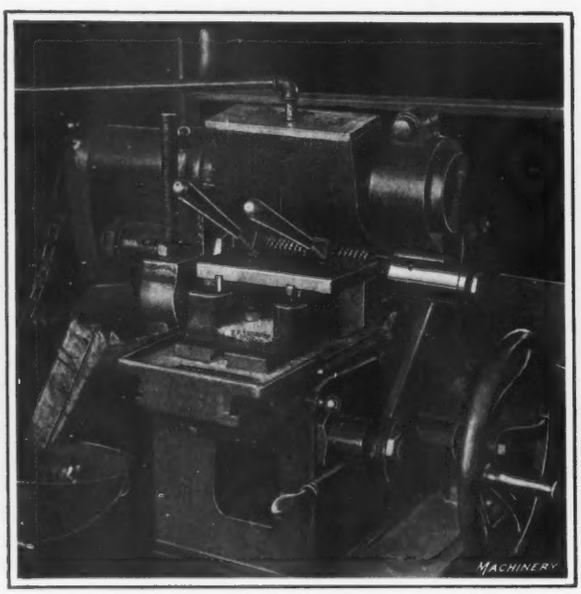


Fig. 3. Milling Machine especially equipped for cutting off Center Blocks for No. 9 Diamond Sprocket Chain for Bicycles from Bar Stock

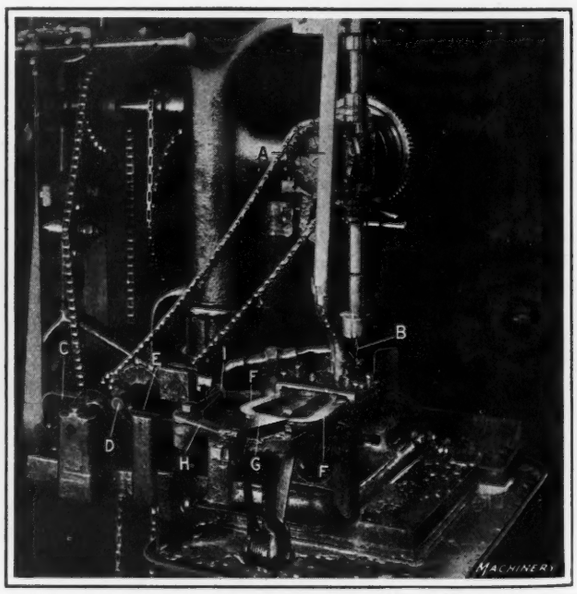



Fig. 4. Single-spindle Drilling Machine with Special Attachments to provide for feeding Blanks to Fixture and drilling Two Holes in Each Blank

The mechanism by which these results are accomplished may be briefly described as follows: At the back of the machine there will be seen a cam *C* which receives its motion from a sprocket-chain drive. Carried on an arm *E* there is a roller *D* which runs in contact with this cam. The entire fixture that holds the work to be drilled is pivoted in such a way that connection of one end of the fixture with arm *E* results in swinging the fixture about its pivotal support in order to bring the work over into position for drilling the second hole, after the first drilling operation has been completed. Reference to the form of cam *C* will make it apparent that this cam is provided with two circular portions or "dwells," which allow the work-holding fixture to remain in a stationary position while either of the two drilling operations in the work is being performed. After an operation has been performed and the drill has been raised out of the hole, the rise on the cam between the smaller and larger sections of circular form results in pushing forward arm *E* and thus swinging over the work-holding fixture in order to bring the fixture into position for receiving a fresh blank. After the first hole has been drilled in this blank and the drill withdrawn from the work, roller *D* comes into engagement with the drop on the cam from the larger to the smaller circular section, and a compression spring holds roller *D* at all times in close contact with cam *C*. Consequently, the roller runs down the cam and allows arm *E* to move backward, thus swinging the fixture over into position for drilling the second hole in the work.

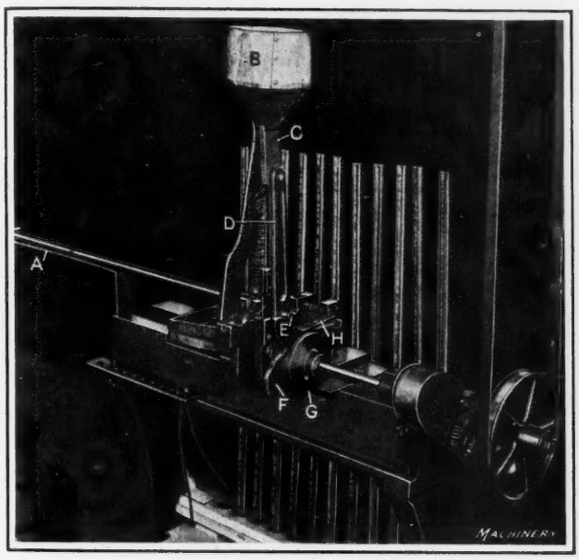



Fig. 5. Special Machine designed for loading Blanks into Feed-chutes used on Drilling Machine shown in Fig. 4

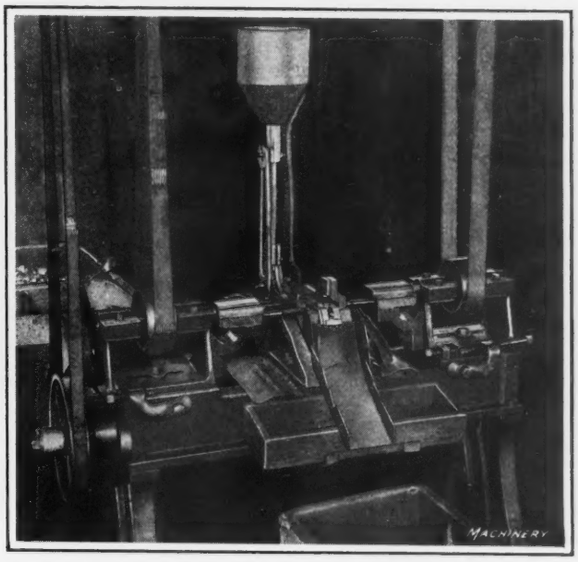



Fig. 6. Special Machine designed for simultaneously countersinking Opposed Ends of Hole in Center Blocks

### Method of Actuating Jaws of Fixture

Having explained the way in which the feeding and indexing of the work is accomplished, attention is now directed to the means which are provided for opening and closing the jaws of the work-holding fixture. Secured to the jaws there are two fingers *F* which have their back ends in contact with a triangular shaped block *G*. When this block *G* is pulled back to the position shown, it causes fingers *F* to swing about their pivotal supports so that the front ends of the fingers, which are in contact with the jaws, cause these jaws to move inward and securely grip the work. After the second drilling operation has been completed and it is required to release the work, this result is accomplished by pushing triangular block *G* forward in order to allow a spring to draw the back ends of fingers *F* together.

Block *G*, which controls the opening and closing of the work-holding jaws, is controlled by means of a bellcrank *H* which has a hook at its rear end that is engaged by a second hook *I*. As roller *D* runs up the rise on cam *C*, causing arm *E* to swing the entire work-holding fixture forward about its pivotal support, it will be apparent that bellcrank *H* will also be drawn forward because the pivotal support of this link is carried by a boss on the work-holding fixture. When it is understood that hook *I*, which engages the hook on the back end of the bellcrank, is not connected to the work-holding fixture, it will at once be apparent that forward movement of the bellcrank will result in pulling the bent end of the bellcrank under hook *I*, and the only way in which this result can be accomplished is to push the opposite end of bellcrank *H* inward, thus sliding triangular block *G* in between the ends of fingers *F* and allowing these fingers to release the grip of the jaws on the work. In this way the jaws release the drilled block so that it may be ejected to make room for a fresh blank that is delivered to the jaws from chute *A*.

It will be seen that chain drives are also used for transmitting motion to the cam mechanism and feed mechanism of these drilling machines, and it has been estimated by engineers of the company that through the application of these positive drives an increase of 30 per cent has been obtained in the production of these machines. Owing to the automatic operation of the machines, one girl operator is able to look after a number of machines and also load the feed-chutes with blanks that are required for feeding each of the machines under her charge.

### Loading the Feed-chutes

To facilitate the work of loading feed-chutes which deliver blanks to the automatic drilling machines illustrated in Fig. 4, special loading machines have been developed, one of which is shown in operation in Fig. 5, one of these loading machines being used in connection with each battery of drilling machines. Referring to this illustration, it will be seen that there are a number of feed-chutes standing in a vertical position; these may be disregarded because they are chutes which have been filled with blanks and are simply standing in a rack ready to be set up on the drilling machines as they may be required. The chute in which we are particularly interested is the one shown at *A* which, it will be seen, lies in a horizontal position. Blanks which are to be loaded in this chute are contained in a hopper *B* from which they descend by gravity, and in order to facilitate the entrance of blanks into the chute down which they travel to be loaded into chute *A*, there is a cam-operated oscillating device placed in hopper *B*. The bottom of the oscillator is seen at *C*, and this is actuated by means of a link *D* that carries a roll *E* running in contact with a three-

lobed cam *F*. As the blanks descend through the vertical chute to reach the end of chute *A*, they are pushed into this chute by means of a slide which is actuated by cam *G* and a link mechanism of which *H* is a part. It will be apparent from the illustration that the respective rollers are kept in continuous contact with cams *F* and *G* by means of coiled springs.

### Countersinking Rivet Holes in Center Blocks

After the rivet holes have been drilled in the center blocks, the work is subjected to a tumbling operation, in order to remove any burrs that are left by the drills as they break through the holes; and when this operation has been completed, the next step in the process of manufacture is to countersink the holes, for which purpose a number of special machines are used, one of which is shown in operation in Fig. 6. It will be seen that this is a four-spindle machine having two sets of horizontal opposed spindles, and twist drills are used for performing the countersinking operation. At the top of the machine there will be seen a hopper in which the blocks are placed so that they may be automatically fed to the work-holding fixture. This automatic feed is accomplished by cams carried on a horizontal shaft at the back of the machine. There is one cam which actuates an agitator in the hopper to facilitate the delivery of blanks into the feed-chute without danger of blocking the entrance to this chute. Another cam operates the cross-slide which pushes the blanks forward into the work-holding fixture; and a third cam operates the clamping mechanism on the fixture to provide for securing the work during the time that the countersinking operation is being performed.

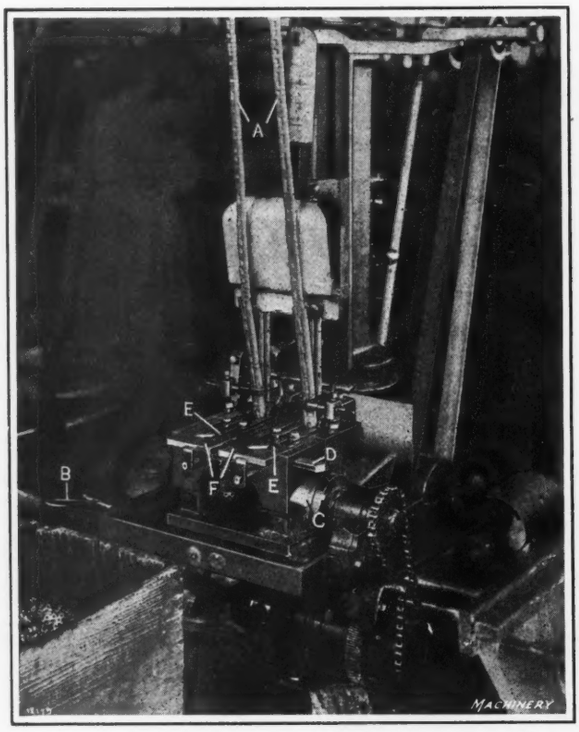



Fig. 7. Single-spindle Drilling Machine equipped with Four-spindle Head and Attachments for automatically feeding Center Blocks to Work-holding Fixtures

Inside the bed of the machine there is a second camshaft provided with cams for oscillating the carriage on which the work-holding fixture is mounted, first in one direction and then in the opposite direction along a line of travel parallel to the bed of the machine. The purpose of this oscillating movement imparted to the carriage is to provide for feeding the work alternately against one pair of drills and then against the pair of drills carried in the opposed spindles, in order to countersink the holes at opposite ends. The feed-cam is synchronized with the cams which actuate the push-rod and clamping mechanism to provide for advancing a center block into the fixture and securing it for the performance of the countersinking operation. As a result of this synchronous operation of the cams, the motions required for placing the work in the fixture, tightening the jaws, and feeding the work first against one pair of drills and then against the other pair, proceed in regular order.

### Reaming the Rivet Holes

After the countersinking operation has been completed on the machine shown in Fig. 6, the next step is to ream the

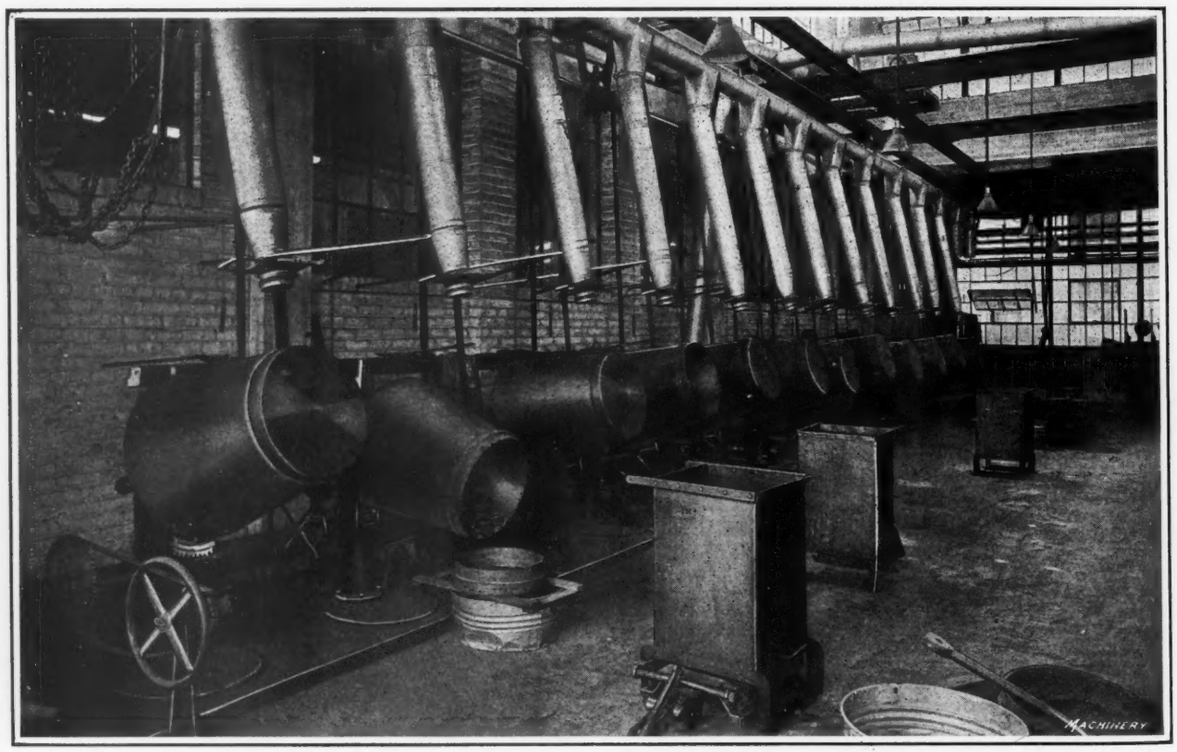



Fig. 8. General View of Tumbling Department, showing Arrangement for delivering Sawdust to Barrels and for carrying away Used Sawdust through an Exhaust System

rivet holes in order that they may be smooth and thus present a good bearing surface on the rivets, so that the chain will be flexible and offer very little resistance to its uniform travel over the sprocket wheels. The reaming operation is performed on machines of the type shown in Fig. 7, where it will be seen that there are four spindles which provide for the simultaneous performance of both reaming operations in two blocks. As in the case of the preceding machines, an automatic feed mechanism is provided for delivering the work to the fixtures on this machine and performing the reaming operation. The blocks are strung on two U-shaped wires shown at *A*, which have their legs spread a sufficient distance apart so that they go through the holes at opposite ends of the center blocks. Quite an ingenious, though simple, method has been provided for loading the blocks onto these U-wires. It consists of using a four-tined fork shown at *B*, which has the tines placed a sufficient distance apart so that the fork may be plunged into a container filled with drilled center blocks and thus enable a large number of these blocks to be scooped up on the fork at each stroke. In this way the tines of the fork become completely loaded with center blocks, and they are then placed opposite the ends of the U-wires so that the blocks may be pushed upon the wires.

As the blocks descend by gravity from the U-wires *A*, they are advanced to the jaws of the work-holding fixture by means of a cam mechanism. This consists of a cam *C* which engages the inclined end of slide *D* which carries cam rollers *E*. It will be seen that these cam rollers run in inclined slots in two horizontal slides *F*, which are provided with push-rods for carrying a block from each of the U-wires *A* into position between the jaws of the work-holding fixtures; these slides are also provided with cams which work in conjunction with suitable mechanism to provide for closing the jaws on the work and holding it while the reaming operation is being performed. The machine on which these reaming operations are performed is a drilling machine built by the Dwight Slate Marking Machine Co., which is provided with a special form of four-spindle drill head. The two pairs of spindles in which the reamers are carried for simultaneously reaming the two holes in each of the two center blocks will be seen in the illustration.

### Special Equipment of the Tumbling Barrel Department

A general view of the tumbling department is shown in Fig. 8, and the special feature of the equipment of this department consists of the means provided for delivering sawdust to the barrels and of removing the used sawdust, the chief idea being to reduce manual labor and avoid having the tumbling department in an untidy condition, which often happens in plants where no special care is taken to provide efficient means of handling the material. Unfortunately, the equipment of the department was not quite completed at the time the photograph was taken, but construction work had gone far enough to enable this picture to give a good idea of the results which can be obtained. Running along over the barrels there will be seen a horizontal delivery pipe with chutes coming down to each barrel. The purpose is to enable the supply of sawdust to be delivered through these pipes by air pressure so that any barrel can be tilted up under the delivery chute and have a charge of sawdust delivered into it. This part of the work had been completed when the photograph was taken.

Just above the floor, behind the machines, there will be seen a second pipe line with an arm extending out beside each machine. This is an exhaust system, and it is the intention to place at the top of each of the branch lines a container into which the contents of a tumbling barrel can be sifted through a sieve in order to separate the sawdust from the product which has been in the barrel. When this apparatus is completed, it will be possible to sift the sawdust into the receiver so that it will be drawn away through the exhaust pipe without requiring any manual labor in handling. This excellent provision for handling the sawdust will not only be the means of saving a great deal of unnecessary work, but it will also enable the sawdust to be immediately carried off instead of following the practice of dumping it on the floor or into some form of portable receiver which obstructs the space around the machine.

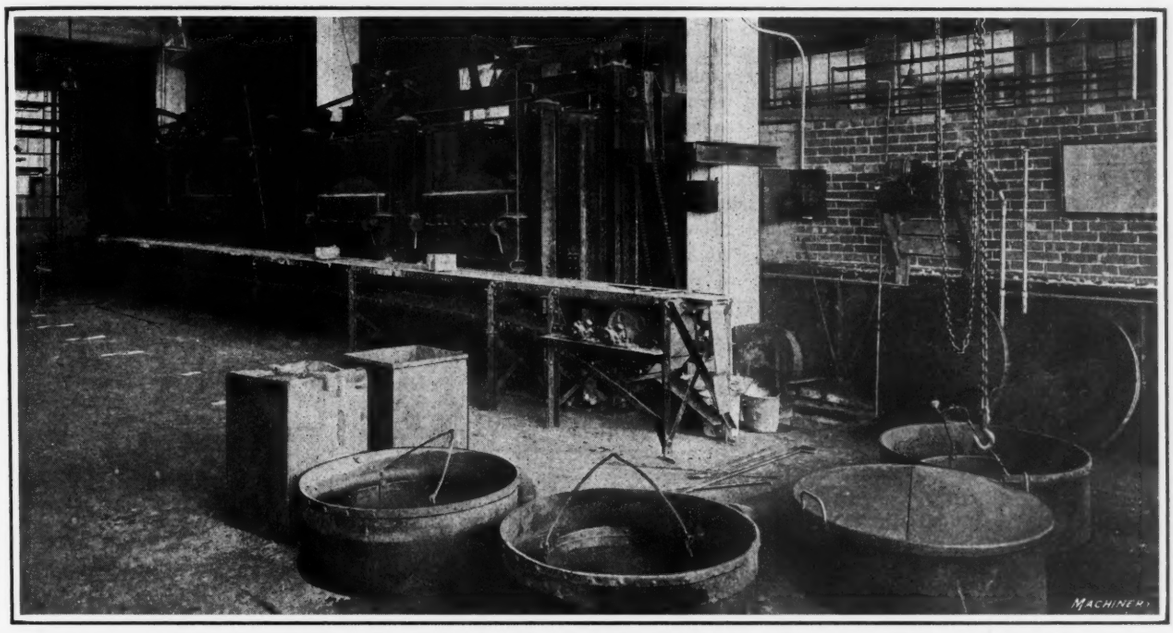


Fig. 9. General View of Heat-treating Department, showing Conveyor System provided for carrying Casehardening Pots from the Furnaces to the Quenching Baths

### Pack-hardening the Blocks

The next step in the process of manufacture is to pack-harden the center blocks, and this is done by following the usual practice of sealing them up in boxes in which the blocks are packed in carbonaceous material, after which they are placed in furnaces and held at a temperature of 1550 degrees F. for a sufficient length of time to allow the carbon to penetrate into the steel to the desired depth. Fig. 9 shows a general view of the heat-treating department, and in this illustration it will be apparent that a conveyor system runs along in front of the furnace doors to facilitate the work of carrying the casehardening boxes from the fur-

nace in which they were heated to the end of the room where the quenching tanks are situated. The boxes are opened and dumped into sieves through which the carbonaceous matter is sifted into sheet-metal boxes, which will be seen at the left of the quenching tanks, after which the contents of the boxes are dumped into the tanks filled with brine. These tanks are cylindrical in shape and about 14 feet deep, with wire mesh baskets extending down in the center of the tanks. The product is dumped into these baskets, and when a sufficient quantity has been quenched the basket is raised out of the tank by means of a chain hoist to allow the quenching solution to drain away, after which the product may be removed from the basket. The furnaces that are used for this process of heat-treatment were manufactured by the American Incandescent Heat Co., of Boston, Mass.

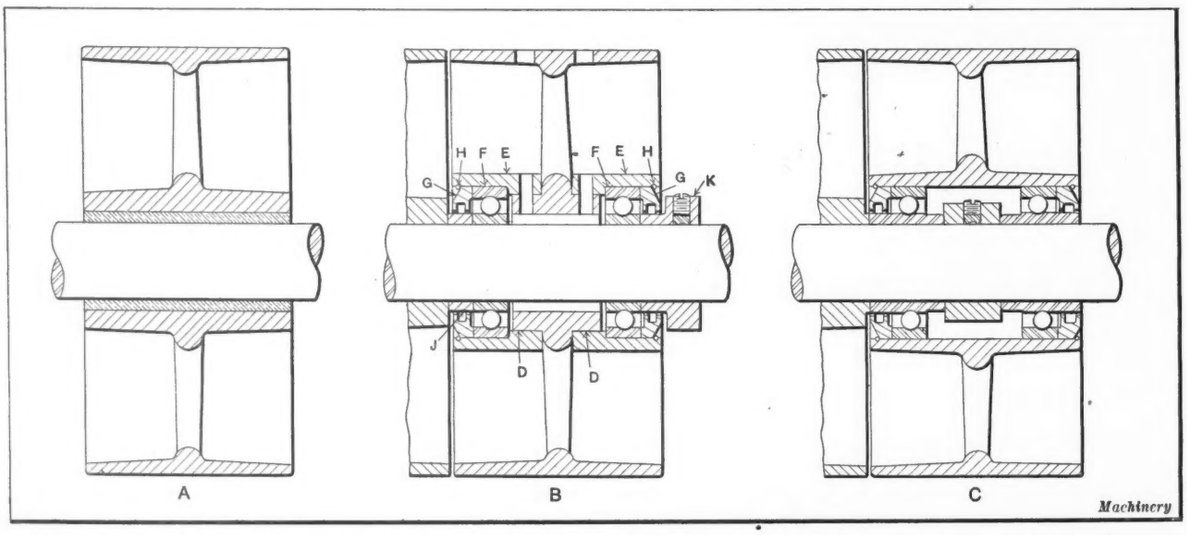
* * *

## EQUIPPING A PLAIN BUSHED PULLEY WITH BALL BEARINGS

When loose pulley bearings become badly worn, they are a source of annoyance in the shop. It is only a question of time before brass or babbitt bushings become worn, resulting in noise and vibration. A worn bushing tends to keep the countershaft rotating and the machinery running after the belt has been shifted to the loose pulley. It is also difficult to retain oil in a plain bushing revolving on a stationary shaft. When loose pulleys are equipped with ball bearings the disadvantages caused by worn bearings are not experienced, as the low coefficient of friction of the ball bearing practically eliminates wear as a factor. As the balls run in hardened steel raceways, the shaft receives no wear and consequently the life of the countershaft is correspondingly increased. The question of lubrication is also simplified, as the lubricant generally may be retained by the ball bearing housing.

It is often possible to equip a plain bushed pulley with ball bearings in order to overcome the disadvantages described in the foregoing. Such a pulley is shown at *A* in the illustration. The same pulley is shown at *B* after it has been equipped with ball bearings by a method recommended by the Fafnir Bearing Co., New Britain, Conn. The procedure followed in making this change is to remove the plain bushing, face back each end of the pulley hub a sufficient amount to allow room for the ball bearings and caps, turn down the outside diameter of the hub at *D*, and square up the shoulders at the pulley arms. The ball bearing housings *E*, which are a press fit on the hub, are then fitted over the turned hub, and are pinned in place in order to prevent slippage. After the housings are in place, they are bored out to a press fit for the outer ball bearing rings *F*. The ball bearings are then assembled in the housings at each end of the pulley, after which caps *G* are inserted. These caps are provided with a groove filled with felt in order to prevent the escape of the lubricant. Finally, a ⅛-inch spring wire ring *H*, is snapped in place, which holds the bearing cap in its proper position.

When the pulley is being mounted on the shaft, the spacer bushing *J* is slid over the shaft against the tight pulley; then the assembled bearings and pulley as a unit are slid over the shaft against this bushing; and finally the thrust collar *K* is placed in position as shown and the set-screw tightened. Care should be taken to see that this collar is not jammed against the ball bearing. The pulley shown at *C* is especially designed for ball bearings. It will be observed that a straight hole is bored through the hub and that grooves are made for the cap-retaining wire rings. When this pulley is mounted on a shaft, a thrust collar is located on the shaft and the set-screw tightened; the pulley is then slipped over the shaft, the left-hand ball bearing is slid into position, the cap put in place, and the retaining ring inserted. The opposite bearing is then installed in a similar manner.




(A) Loose Pulley having a Plain Bushing. (B) Same Pulley equipped with Ball Bearings. (C) Pulley designed especially for Ball Bearings

* * *

## NATIONAL CONVENTION OF AMERICAN STEEL TREATERS' SOCIETY

The national convention of the American Steel Treaters' Society will be held in the Seventh Regiment Armory, Wentworth Ave. and 34th St., Chicago, Ill., during the week of September 22 to 27. It is planned to have a very interesting line of papers and addresses on the heat-treatment of steel presented, covering the whole range of steel products, including steel for structural purposes; for machine parts; oil-treated or casehardened; for cutting purposes, whether used as cutting tools in regular machine tools for constant cutting, like lathe tools, planer tools, milling cutters, drills, etc., or for punches, dies, shear-knives, chisels, etc.; for electrical purposes; for ordnance; and for springs, sheets, rails, wires, etc. During the week of the convention, the society will also hold an exhibit of heat-treating appliances, and of heat-treated products, a contract having been made to rent an exposition building in Chicago with 26,000 feet of floor space. During the same week in which the convention of the American Steel Treaters' Society is held, the American Institute of Mining Engineers' convention, and the National Chemical Exposition will also be held in Chicago. The arrangements for the convention are under the direction of L. J. Murphy, chairman of the Exhibit Committee, 154 E. Erie St., Chicago, Ill., from whom further information may be obtained by those interested.

# Practical Applications of the Combined Stress Theory

By N. BARNES HUNT, Assistant Engineer, United States Reclamation Service, Denver, Colo.

THE following formulas are based upon the true stresses in structural members and apply to cases in which an axial tensile or compressive stress acts in combination with a transverse shearing stress. Cases involving three stresses at right angles are not included. As to the propriety of using true stresses in design, reference is made to Mansfield Merriman's "Mechanics of Materials" and a discussion of combined stresses by A. Lewis Jenkins in the *Journal of the American Society of Mechanical Engineers* for August, 1917. Merriman gives the following general formulas for true stress:

When the axial stress is tension,

$$S_t = 1/2\ (1 - R)\ S_{ts} + (1 + R)\ \sqrt{S_{ss}^2 + (1/2\ S_{ts})^2} \quad (1)$$

$$S_s = (1 + R)\ \sqrt{S_{ss}^2 + (1/2\ S_{ts})^2} \quad (2)$$

When the axial stress is compression,

$$S_c = 1/2\ (1 - R)\ S_{cs} + (1 + R)\ \sqrt{S_{ss}^2 + (1/2\ S_{cs})^2} \quad (3)$$

$$S_s = (1 + R)\ \sqrt{S_{ss}^2 + (1/2\ S_{cs})^2} \quad (4)$$

in which

$S_t$ = true unit tensile stress;
$S_s$ = true unit shearing stress;
$S_c$ = true unit compressive stress;
$S_{ts}$ = simple unit tensile stress;
$S_{ss}$ = simple unit shearing stress;
$S_{cs}$ = simple unit compressive stress;
$R$ = Poisson's Ratio.

When the material is equally strong, or nearly so, in tension and compression these are the only formulas needed. When this is not the case, the following formulas should be used in addition to the foregoing:

When the axial stress is tension,

$$S_c = \frac{(1 - R)\ S_{ts}}{2} - (1 + R)\ \sqrt{S_{ss}^2 + (1/2\ S_{ts})^2} \quad (5)$$

When the axial stress is compression,

$$S_t = \frac{(1 - R)\ S_{cs}}{2} - (1 + R)\ \sqrt{S_{ss}^2 + (1/2\ S_{cs})^2} \quad (6)$$

The stress should be within allowable limits in every case. Values of $R$ for some structural materials are given in the following table:

| Material | R | Material | R |
|---|---|---|---|
| Steel | 0.333 | Brass | 0.333 |
| Wrought iron | 0.333 | Copper | 0.333 |
| Cast iron | 0.250 | Lead | 0.430 |

### Flexure and Torsion

Shafting exemplifies the combination of flexure and torsion. Using the tensile stress and neglecting the compressive stress due to flexure, Formulas (1) and (2) cover the case of solid round shafting when the material is equally strong in tension and compression. The values of $S_{ts}$ and $S_{ss}$ are found from the flexure and torsion formulas respectively, or

$$S_{ts} = \frac{M_b c}{I_r} \quad (7) \qquad S_{ss} = \frac{M_t c}{I_p} \quad (8)$$

in which

$M_b$ = bending moment in inch-pounds;
$M_t$ = torsional moment in inch-pounds;
$c$ = distance from neutral axis to extreme fiber in inches;
$I_r$ = rectangular moment of inertia;
$I_p$ = polar moment of inertia.

Assuming $R = 1/3$ for steel and substituting in (1) and (2) for $S_{ts}$ and $S_{ss}$ the values on the right of the sign of equality in (7) and (8),

$$D^3 = \frac{32}{3\pi S_t}\ (M_b + 2\ \sqrt{M_t^2 + M_b^2}) \quad (9)$$

$$D^3 = \frac{64}{3\pi S_s}\ \sqrt{M_t^2 + M_b^2} \quad (10)$$

in which $D$ = diameter of shaft in inches. The greater of the two values of $D$ should govern the size of the shaft.

*Example*—Required the diameter of a shaft to resist a bending moment of 3000 inch-pounds and a torsional moment of 20,000 inch-pounds, allowing 10,000 pounds per square inch in tension and 8000 pounds in shear. Using Formula (9):

$$D^3 = \frac{32}{3\pi \times 10{,}000}\ (3000 + 2\ \sqrt{20{,}000^2 + 3000^2})$$

$$D = 2.45 \text{ inches}$$

From Formula (10):

$$D^3 = \frac{64}{3\pi \times 8000}\ \sqrt{20{,}000^2 + 3000^2}$$

$$D = 2.58 \text{ inches}$$

In this case, the diameter depends upon the shearing stress due to torsion, but the bending moment may be so great that the tension will govern. The compressive stress might be used instead of the tensile stress in combination with shear, since the tension and compression are equal. If this is done (3) and (4) will be the fundamental formulas instead of (1) and (2). The reason for neglecting the shear analogous to that in a beam is stated in the following under the sub-head "Flexure and Shear."

### Axial Compression and Torsion

Axial compressive and torsional stresses exist in gate stems when a gate is lowered under water pressure; in such cases compression usually imposes more severe conditions than does tension in raising the gate. The resistance to lowering is that of friction on the gate seat due to the pressure of water against the gate. Rankine's column formula permits the determination of the existing unit stress, and for this reason Merriman uses it when compression is combined with torsion. The following formulas apply to solid round stems. When the material is equally strong in tension and compression, Formulas (3) and (4) fulfill the requirements. The values of $S_{cs}$ and $S_{ss}$ are given by the compression and torsion formulas. The former is:

$$S_{cs} = \frac{P}{A}\left[1 + C\left(\frac{L}{r_g}\right)^2\right]$$

Using these values with $R = 1/3$ for steel as before, the formulas become:

$$S_c = \frac{\frac{P}{A}\left[1 + C\left(\frac{L}{r_g}\right)^2\right]}{3} + \frac{4}{3} \times \sqrt{\left(\frac{16 M_t}{\pi D^3}\right) + \left(\frac{\frac{P}{A}\left[1 + C\left(\frac{L}{r_g}\right)^2\right]}{2}\right)^2} \quad (11)$$

$$S_s = \frac{4}{3}\sqrt{\left(\frac{16 M_t}{\pi D^3}\right)^2 + \left(\frac{\frac{P}{A}\left[1 + C\left(\frac{L}{r_g}\right)^2\right]}{2}\right)^2} \quad (12)$$

in which

$P$ = total compressive load in pounds;
$A$ = cross-sectional area in square inches;
$C$ = constant depending upon end conditions;
$L$ = unsupported length in inches;
$r_g$ = radius of gyration in inches.

$D$ is found by trial, and the greater value, using both formulas, will be the proper diameter.

Merriman's values for $C$ are given in the following table:

| Material | C | | | |
|---|---|---|---|---|
| | Both Ends Fixed | Fixed and Round | Both Ends Round | Fixed and Free |
| Steel | $\frac{1}{25{,}000}$ | $\frac{1.95}{25{,}000}$ | $\frac{4}{25{,}000}$ | $\frac{16}{25{,}000}$ |
| Wrought iron | $\frac{1}{36{,}000}$ | $\frac{1.95}{36{,}000}$ | $\frac{4}{36{,}000}$ | $\frac{16}{36{,}000}$ |
| Cast iron | $\frac{1}{5000}$ | $\frac{1.95}{5000}$ | $\frac{4}{5000}$ | $\frac{16}{5000}$ |

*Machinery*

*Example*—Required the diameter of a gate stem with an unsupported length of 10 feet which must resist a compressive load of 27,250 pounds and a torsional moment of 10,000 inch-pounds, allowing 12,000 pounds per square inch in compression and 10,000 pounds per square inch in shear. Assume that one end of the column is fixed and the other round or hinged, a condition for which Merriman gives $C = \frac{1.95}{25{,}000}$ when the material is steel. Using 3 inches as a trial diameter, from which $A = 7.07$ square inches in Formula (11):

$$S_c = \frac{\frac{27{,}250}{7.07}\left[1 + \frac{1.95}{25{,}000}\left(\frac{120}{0.75}\right)^2\right]}{3} + \frac{4}{3} \times \sqrt{\left(\frac{16 \times 10{,}000}{27\pi}\right)^2 + \left(\frac{\frac{27{,}250}{7.07}\left[1 + \frac{1.95}{25{,}000}\left(\frac{120}{0.75}\right)^2\right]}{2}\right)^2}$$

$S_c = 11{,}960$ pounds

From Formula (12):

$$S_s = \frac{4}{3} \times \sqrt{\left(\frac{16 \times 10{,}000}{27\pi}\right)^2 + \left(\frac{\frac{27{,}250}{7.07}\left[1 + \frac{1.95}{25{,}000}\left(\frac{120}{0.75}\right)^2\right]}{2}\right)^2}$$

$S_s = 8110$ pounds

The true compressive stress is close to the allowable limit and the diameter, therefore, should not be decreased although the true shearing stress is considerably below the allowable limit.

### Axial Tension and Cross-shear

This class includes members in which the tensile stress is uniformly distributed over the cross-section. It does not include tension due to flexure. Regarding shear, there are two cases, namely, shear which is uniformly distributed over the cross-section and shear which is greatest at the neutral axis. Unwin states that cross-shear is uniformly distributed over the cross-section, provided no bending occurs in the member under stress. This condition is illustrated in rivets. Bending is assumed to occur in bolts, cotters, etc., because of their loose fit. When $P_1$ is the load-producing tension:

$$S_{ts} = \frac{P_1}{A} \qquad (13)$$

Unwin gives the following values of maximum unit cross-shear when $P_2$ is the load-producing shear:

When no bending occurs,

$$S_{ss} = \frac{P_2}{A} \qquad (14)$$

When bending occurs, the formulas for different cross-sections are:

Rectangular Cross-section and $P_2$ Perpendicular to One Side:

$$S_{ss} = \frac{3}{2}\left(\frac{P_2}{A}\right) \qquad (15)$$

Square Cross-section and $P_2$ Acting in Direction of Diagonal:

$$S_{ss} = \frac{9}{8}\left(\frac{P_2}{A}\right) \qquad (16)$$

Circular or Elliptical Cross-section:

$$S_{ss} = \frac{4}{3}\left(\frac{P_2}{A}\right) \qquad (17)$$

The true stresses are given by Formulas (1) and (2) when the material is equally strong in tension and compression. In the case of bolts, assuming $R = 1/3$ and substituting the values of $S_{ts}$ and $S_{ss}$ given in Formulas (13) and (17), calling $A = 1/4\pi D^2$, they reduce to:

$$D^2 = \frac{4P_1 + 16\sqrt{\left(\frac{4P_2}{3}\right)^2 + \left(\frac{P_1}{2}\right)^2}}{3\pi S_t} \qquad (18)$$

$$D^2 = \frac{16}{3\pi S_s}\sqrt{\left(\frac{4P_2}{3}\right)^2 + \left(\frac{P_1}{2}\right)^2} \qquad (19)$$

As before, the greater value of $D$ should be used.

*Example*—Required the diameter of a bolt to resist a tensile stress of 8000 pounds and a cross-shear of 10,000 pounds, allowing 12,000 pounds per square inch in tension and 10,000 pounds per square inch in shear. Using Formula (18):

$$D^2 = \frac{4 \times 8000 + 16\sqrt{\left(\frac{4 \times 10{,}000}{3}\right)^2 + \left(\frac{8000}{2}\right)^2}}{36{,}000\pi}$$

$D = 1.50$ inch

From Formula (19):

$$D^2 = \frac{16}{30{,}000\pi}\sqrt{\left(\frac{4 \times 10{,}000}{3}\right)^2 + \left(\frac{8000}{2}\right)^2}$$

$D = 1.54$ inch

The formulas for rivets may be derived by substituting the values of $S_{ts}$ and $S_{ss}$ given by Formulas (13) and (14).

### Flexure and Shear

The shear considered under this caption is that found in a beam, and is therefore zero at the extreme fiber and a maximum at the neutral axis; consequently, it is not comparable with shear due to torsion. The tension and compression due to flexure are, on the other hand, a maximum at the extreme fiber where it is known that the stresses in a beam are greatest. For this reason these stresses, according to Merriman, should not be considered in combination and, practically, the tension or compression calculated from the flexure formula may be taken as the true stress. The slight error involved in neglecting the vertical compression produced by a load is ordinarily ignored. Likewise the shear calculated from Formulas (15), (16), and (17) may be considered a true stress.

### Allowable Unit Stress

Unit stresses allowed in design when no combination of stresses takes place would logically be adopted for use under the conditions herein described. When a member is subject to variable stress, lower working stresses are often used. This is true of shafting. The working stresses used in illustrating the applications of the formulas are believed to represent the recent tendency toward larger factors of safety.

# Making Cobaltcrom Steel Tools

COBALTCROM steel is an alloy steel invented and patented by P. R. Kuehnrich, chairman of Darwin & Milner, Ltd., the well-known steel manufacturers of Sheffield, England. The combination of cobalt and chromium is the chief feature of this remarkable material, which is used by the Alloy Cast Tool Co., Front and West 9th Sts., Cleveland, Ohio, in the making of dies, milling cutters, and other tools possessing unusual wearing qualities. An interesting feature of this steel is that the dies, milling cutters, etc., made from it can be cast to shape, the teeth in the cutters, for example, being cast directly in the blank and requiring no other machining than grinding and the boring or sometimes only the reaming of the hole.

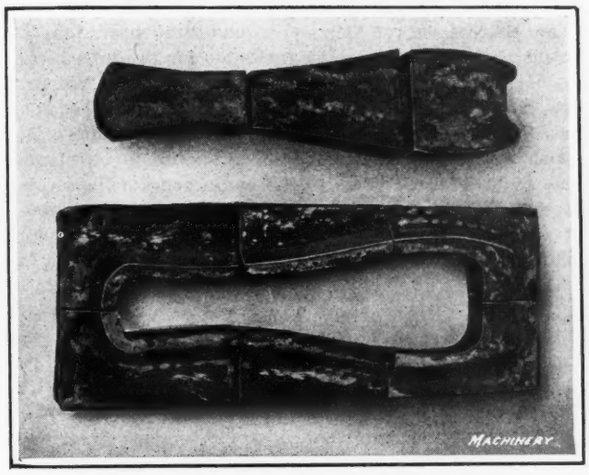



Fig. 1. Sectional Punch and Die made from Cobaltcrom Steel

### Method of Making Tools from Cobaltcrom Steel

The raw material for the dies and other tools made from cobaltcrom steel is obtained by the Alloy Cast Tool Co., in pig form, from Darwin & Milner, Ltd. These small pigs are then remelted in crucibles, no additions being made except that a flux is used to protect the surface while melting and pouring. The remelting temperature is from 2800 to 3000 degrees F., and as the steel is extraordinarily fluid when poured at this high temperature, it will fill the molds accurately.

The molds are made in much the same way as molds for ordinary iron castings, except that special facings must be employed, these being made from high-fusing sands and binders. After the molds have thus been made and faced, they are baked in an oven until they are quite hard. The steel is then poured from the crucibles into the molds, from which the blanks for the dies and tools are removed after having cooled off.

Before the blanks can be machined, they must be annealed; this operation is performed by pack-annealing at the temperature of 1800 degrees F., for a period of from three to six hours, according to the size of the castings being annealed. The furnace is raised to the temperature mentioned, and the castings are soaked at this heat for the time specified, after which the packed blanks are permitted to cool off slowly with the furnace. After this annealing, the blanks can be machined as required; but it is evident that, as the teeth and forms of the tools are cast directly in the blank, there is very little machining to be done. It is a little more difficult to machine annealed cobaltcrom steel than it is to machine ordinary carbon tool steel, but it machines more easily than high-speed steel.

After having been machined, the tools are hardened in much the same way as carbon tool steel would be hardened. The advantage of the cobaltcrom steel, however, in hardening, is that, practically speaking, it does not change at all when correctly hardened.

While cobaltcrom steel has the wearing qualities of high-speed steel, the heat-treatment is much more simple than that necessary for the latter, because cobaltcrom steel does not require the extreme hardening temperatures which destroy the fine edges on high-speed steel tools, and there is no risk of cracking in hardening. Furthermore, there is no need of drawing the temperature of cobaltcrom steel tools, except in a few instances. Another advantage with cobaltcrom steel tools is that they are practically non-rusting and acid-proof.

### Hardening Cobaltcrom Steel

The following directions are given for the hardening of blanking and trimming dies, milling cutters, and similar tools made from cobaltcrom steel: Heat slowly in a hardening furnace to about 1830 degrees F., and hold the temperature at this point until the tools are thoroughly soaked. Then allow the heat to drop about 50 degrees, withdraw the tools from the furnace, and allow them to cool in the atmosphere. As soon as the red color disappears from the cooling tool, place it in quenching oil until cold. The slight drop of 50 degrees in temperature while the tool is still in the hardening furnace is highly important in order to obtain proper results. The steel will be injured if the tool is heated above 1860 degrees F. In cooling milling cutters or other rotary tools, it is suggested that they be suspended on a wire to insure a uniform rate of cooling.

Tools that are subjected to shocks or vibration, such as pneumatic rivet sets, shear blades, etc., should be heated slowly to 1650 degrees F., after which the temperature should be permitted to drop to about 1610 degrees F., at which point the tool should be removed from the furnace and permitted to cool in the atmosphere. There is no appreciable scaling present in the hardening of cobaltcrom steel tools.

Should it be required to rework tools that have been hardened, they may be annealed by heating them to 1830 degrees F. in a closed muffle, and permitting them to cool slowly; the slower the cooling, the softer will be the annealed cutter. Sand or ashes, with a slight amount of charcoal added, has proved to be a satisfactory packing material during annealing.

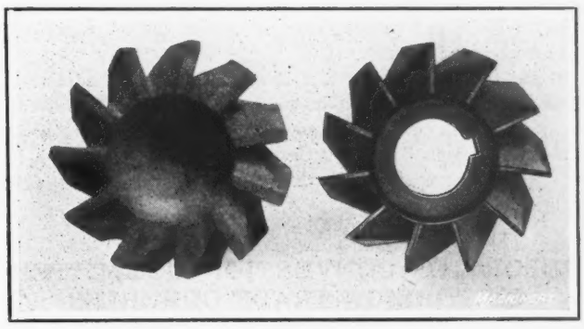


Fig. 2. Cutter Casting and Finished Cutter

### Purposes for which Cobaltcrom Steel Tools are Used

Cobaltcrom steel has been found especially satisfactory for blanking and drawing dies. In one case, a cobaltcrom steel blanking die, 5 inches in diameter, used in the manufacture of tin cans, was employed on unpickled scaly, black sheets, No. 22 gage, and lasted for 150,000 blanks between grindings,

while carbon steel dies on an average would last for only 5000 blanks between grindings. In another case, the die shown in Fig. 1 was used by a stove manufacturer for blanking stove legs, and 280,000 blanks were produced with one grinding, while, with high-speed steel dies, only 80,000 blanks were produced between grindings. While these examples may be extremely favorable, it is claimed, as a conservative estimate, that cobaltcrom steel dies have been found to last from two to three times as long between grindings as high-speed steel dies, and from six to eight times as long as carbon steel dies.

### Milling Cutters Made from Cobaltcrom Steel

Side milling cutters, face mills, and end mills have been made from cobaltcrom steel and proved satisfactory. The best results obtained are for milling cutters with coarse spacing of the teeth. The advantage of these cutters is the greater wearing qualities, it being claimed that cutters made from this material will last from two to three times as long between grindings as high-speed steel cutters. Fig. 2 shows, to the left, a milling cutter as the blank comes from the molds, and, to the right, the state when the cutter has been ground, the hole bored, and the cutter is ready for use.

### Cost of Tools Made from Cobaltcrom Steel

An important consideration in connection with the use of cast cobaltcrom steel tools is the cost as compared with high-speed steel or carbon steel tools made from solid bars or blanks. Cobaltcrom is more expensive, pound for pound, than high-speed steel, but on account of the fact that the blanks can be cast to practically the correct size, there is very little waste of material in machining, and hence the actual amount of raw material used for many tools costs less than the material necessary if the tool were worked up entirely from a piece of high-speed steel. Furthermore, the largest part of the machining work is eliminated, as the tool is cast so nearly to size, that it will require, in some cases, only grinding, and in other cases, only a small amount of machining. Hence, an allowance of from 1/16 to 1/8 inch for finish is enough on tools that are cast from cobaltcrom steel. Generally speaking, the makers of cobaltcrom steel blanks state that the cost of cutters from 5 to 7 inches in diameter, when made from cobaltcrom steel, will probably be one-half the cost of the same cutters made from high-speed steel. On special tools requiring a great deal of machining work, and considerable waste of material, the price of the cobaltcrom steel tool is stated to be only one-third of the cost of the same tool made from high-speed steel, this, in spite of the fact that the price of the cobaltcrom steel is from 25 to 50 per cent higher per pound than the price of good high-speed steel.

In addition to the reduction in cost, there is the advantage of wear and the retention of good edges during the hardening. The risk of breakage in hardening is practically avoided. In fact, the Alloy Cast Steel Co. states that in its experience no die made from cobaltcrom steel has even broken in hardening.

* * *

## REPORT OF CONVENTION COMMITTEE OF FOREIGN TRADE CONGRESS

The General Convention Committee of the Sixth National Foreign Trade Convention held in Chicago in the latter part of April, has presented a report embodying the main conclusions reached at the convention. The report, which may be obtained from the National Foreign Trade Council, 1 Hanover Square, New York City, points out the effect of the war on the course of foreign trade and emphasizes that the United States must find compensating outlets to take the place of some of the trade channels that were obstructed through the war. Special emphasis is laid upon the merchant marine needs, and government operation of shipping is opposed. American cables and wireless service are demanded and the establishment of a department of commercial aeronautics is urged. The establishment of free zones at the principal American ports where products from all countries can be assembled, classified, manufactured and reshipped, with the object of thereby escaping the restrictive effects of the protective tariff, is advocated and a bargaining tariff is demanded for the protection of American commercial interests in foreign countries. The extension of the parcels post is also advocated, it being pointed out that the United States at present enjoys parcels post communication with but approximately one-half as many countries as does Great Britain. Great stress is also laid upon the fact that foreign trade is entitled to government support, that the consular service should be extended and better facilities provided for obtaining reports of value to those engaged in foreign trade. The commercial attaché and trade commissioner service of the Bureau of Foreign and Domestic Commerce should be materially expanded and placed upon a permanent basis with an adequate scale of compensation.

* * *

## MACHINE TOOLS FOR CHINA

The Department of Commerce has announced that the present time seems especially favorable for the introduction of American machine tools in China because of the industrial development now taking place in that country. Other countries, it is stated, are fully aware of this opportunity, and British manufacturers have been arranging to supply machine tools free of charge to the engineering college established at Hongkong as well as to a number of other Chinese industrial schools. In order to introduce American machine tools in China, it is believed to be an excellent plan to furnish machinery to industrial and manual training schools in that country, many of which are now in existence, while many others are being planned. The ordinary Chinese manual training school requires 12-, 14-, and 16-inch engine lathes of the gap type. The best size for planers is 24 by 24 by 48 inches; 14- and 16-inch shapers are also required, as well as small milling machines, grinding machines, wood turning lathes, circular saws and band saws, etc. American manufacturers interested in this matter may obtain further information by addressing the Chief of the Far Eastern Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. The Department believes that it would be of great advantage to American manufacturers if they could see their way clear either to present machine tools to these schools or to sell them at reduced prices. Julean Arnold, commercial attaché, Peking, China, will also supply particulars and cooperate in every way with those interested in this proposition.

* * *

## NATIONAL SCREW THREAD COMMISSION GOES TO EUROPE FOR CONFERENCE

The National Screw Thread Commission created by Act of Congress to consider the standardization of screw threads and matters in connection with the use of threaded parts, sailed for Europe on the *Leviathan*, Sunday, July 13. The commission will confer with British and French engineers with regard to the possible establishment of an international screw thread standard, and will confer in England with the British Engineering Standards Association. The delegation consisted of Dr. S. W. Stratton, chairman; Lieutenant Colonel E. C. Peck, vice-chairman, representative of the U. S. Army; Captain John O. Johnson, representative of the U. S. Army; Commander L. B. McBride, representative of the U. S. Navy, at present attached to the American Embassy, London; F. O. Wells, representative of the A. S. M. E.; Luther D. Burlingame, representative of the A. S. M. E., alternate for James Hartness; H. L. Horning, representative of the S. A. E., alternate for E. H. Ehrman; Earle Buckingham, representative of the S. A. E., alternate for H. T. Herr; and H. W. Bearce, and Lieutenant Robert Lacy, technical secretaries.

# LETTERS ON PRACTICAL SUBJECTS

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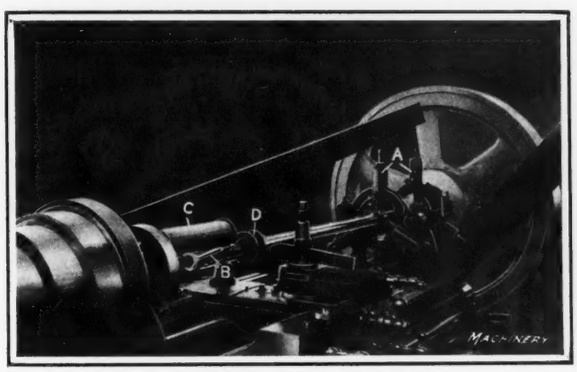
## BORING A LARGE FLYWHEEL ON A SMALL ENGINE LATHE

The boring of a 39-inch flywheel for which no lathe of sufficient size was available was satisfactorily performed by using the equipment shown in the accompanying illustration. The manner of doing the job should be of interest in view of the fact that similar obstacles are commonly encountered in the shop. The 18-inch engine lathe that was used had a 1¼-inch bore in the spindle, and a boring-bar was made from 1¼-inch shafting to fit this hole. The bar was made long enough to extend beyond the end of the lathe and was slotted in the end so as to allow the boring tool to be inserted in it. The two steadyrests *A* were first lined up with the center of the spindle and the lathe tailstock was removed. The flywheel was then blocked up at the end of the lathe as shown, and braced in this position. A tram attached to the end of the boring-bar was used to line up the wheel, the tram being run around the rim. The boring-bar, extending well into the lathe spindle, was driven by means of a lathe dog *B* which was fastened to the bar and which rested against a piece of pipe *C*, bolted near the outer edge of the faceplate. The bar was fed into the work by using a collar *D* fastened to the bar, which was engaged by




Engine Lathe set up for boring the Flywheel

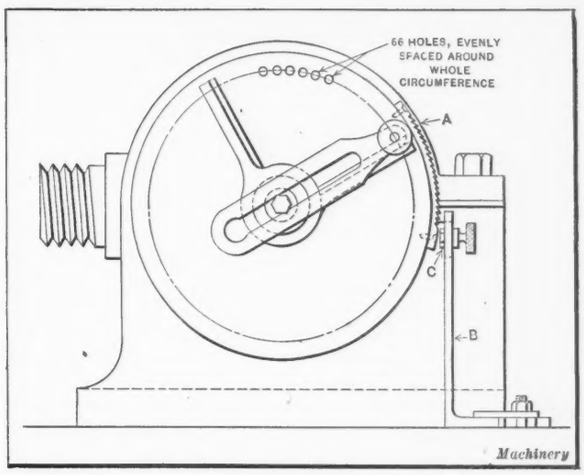
a tool shank secured in the regular toolpost. In this way the carriage feed was used to advance the boring tool by pushing against the collar, and the job was readily done.

Woodstock, Ill. R. H. SHARP

## SPECIAL COMPOUND INDEXING DEVICE

The diagram shows an indexing device that was used while cutting 15 teeth in a gear segment, the diametral pitch of which was equivalent to that of a gear having 178 teeth. The index-plate which would give the nearest spacing to that required, and which was available in the shop, was one for 176 divisions, using a 66-hole circle. The device illustrated was used in connection with this plate to turn the work backward a sufficient amount to index correctly for 178 teeth. A special plate *A* was made from a flat bar of cold-rolled steel, ⅛ inch thick. Sawteeth having an angle of 45 degrees were milled in this plate, which was then bent to fit the circumference of the 66-hole index-plate and secured to it by two screws. The distance between each sawtooth was made equal to the difference between the 176-tooth spacing and the required 178-tooth spacing at the outside diameter of plate *A*.

The radius of plate *A* was 4⅛ inches. In indexing 15 holes on a 66-hole circle, as required for one tooth in a 176-tooth gear, the distance that any point on the circumference




Indexing Device for turning Work back to correct Error of Regular Index-plate Spacing

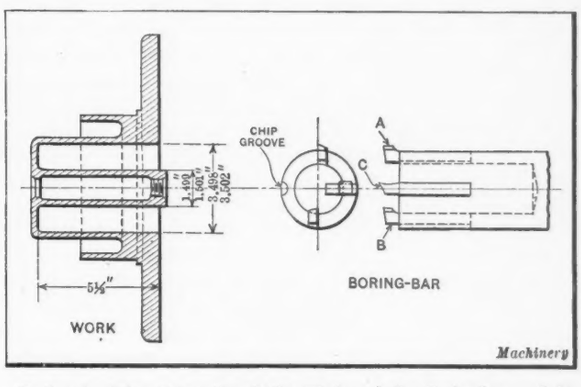
of this plate travels equals $\frac{4.125 \times 2 \times 3.1416 \times 15}{66} = 5.891$ inches; and the amount of travel in indexing 20 holes in an 89-hole circle, as required for spacing one tooth in a 178-tooth gear, equals $\frac{4.125 \times 2 \times 3.1416 \times 20}{89} = 5.824$ inches. The difference between these two values, or 0.067 inch, represents the distance between each of the milled teeth on plate *A*. The pawl *C* engaged these teeth, being held in position on strap *B* by means of a thumb-screw.

When this device was used, the sector on the index-head was set for 15 holes on the 66-hole circle and pawl *C* was set to engage the lowest tooth on plate *A*, as shown in the illustration. After one tooth on the gear segment was milled, the index-plate was turned to the right distance of one tooth on *A*, and then, with pawl *C* engaging the second tooth, the crank was turned 15 holes to the left and the next segment tooth milled, this procedure being continued until all the teeth were milled. The plate *A* was always indexed before the regular indexing, to overcome backlash of the gearing.

Philadelphia, Pa. PAUL H. BYER

## DEEP BORING OPERATION ON A LATHE

The lathe job shown in the accompanying illustration presented some difficulties at first, but these were finally overcome as described in the following. The work contains a hole which is 3 1/2 inches in diameter by 5 1/2 inches




Casting involving Interesting Lathe Work and the Boring-bar used in Connection with it

deep. Concentric with the bore is a turned pilot 1 1/2 inch in diameter, extending 1/4 inch past the face of the work. As a piston operates in the bore and on the pilot, it is obvious that the machining operations are required to be performed accurately. The work was previously done on an engine lathe by boring in about an inch at a time and then turning for a similar distance until the end of the bore was finally reached. The interior of the base was faced as a final operation, but this facing operation was often omitted because the tools caused much trouble on account of not being rigid enough. The length of the bore and the small amount of clearance afforded frequently resulted in the breaking off of the pilot close to the base.

The work is now machined in a turret lathe in the following manner: The part is first chucked and the work on the side opposite the face completed, after which the casting is reversed and located in a pot chuck preparatory to the facing, boring, and turning operations. The boring-bar is drilled out in the center as shown, to accommodate the turned pilot as the operation proceeds. A 1/2-inch square tool *A* performs the boring operation, while a similar tool *B* of the opposite hand, is used for turning the pilot. These tools are located diametrically opposite each other and are held in the slots in the boring-bar by means of headless set-screws. The faces of the tools are located on the vertical center line of the bar in order that any error that might occur in indexing the turret would affect the size of the bore and the pilot only slightly, and also as a means of preventing the tools from digging into the work when facing the interior of the base. While the boring and turning operations are in process, the flange is turned and faced by the cross-slide tools. On account of warpage of the pilot after the scale is removed and the strain on the casting is relieved by the removal of stock, it is necessary to allow the casting to season for several days following the rough-boring and turning operations and before taking the finishing cuts, at which time the tapping and other minor operations are performed.

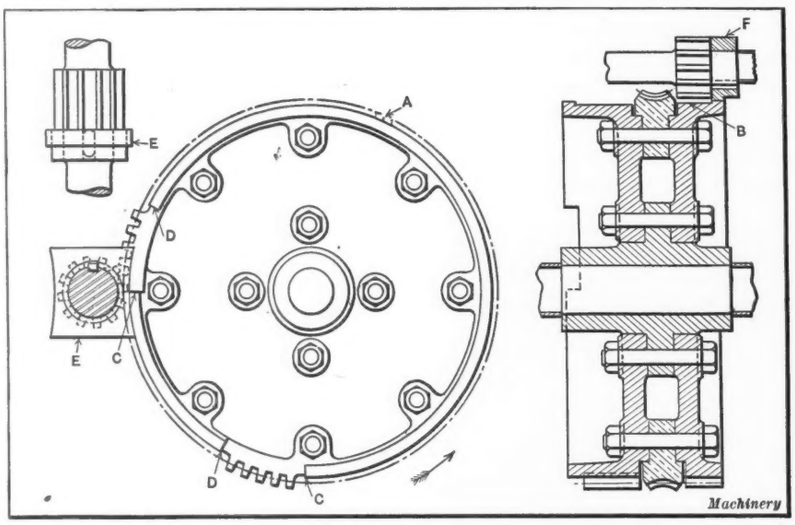
A facing tool *C*, having a cutting edge of a little over one-half the width of the base, is placed in a slot which is located 90 degrees from the other two slots. The tool is fastened so as to extend past the end of the turning and boring tools, being first set to the radius of the bore, and then so as to face the base up to the turned pilot. In this way the base, the bore, and the pilot are finished. The type of boring-bar shown is well adapted for this job, and being very rigid, it holds the sizes perfectly after the tools are once set. A longitudinal groove is milled in the bar opposite the slot for tool *C*, to provide clearance for the chips. The work can now be done in one quarter of the time formerly consumed and without producing any scrap or broken parts.

A. R. A.

## INTERMITTENT GEARS WITH LOCKING CIRCLES

On page 856 of the May number of MACHINERY, two designs of intermittent gears are presented, the locking circles of which are located in planes adjacent to the tooth circle planes. The form of locking circle shown at *A* in the illustration which accompanies the article referred to is not easily manufactured, because it is not a simple machine shop operation to mill the different stops and the locking circle. The construction shown at *C* in the same illustration is a better design, but unless a Fellows gear shaper is used, it is necessary to allow a large clearance space between the teeth on the driver and the locking circle which is cast integral with it. It is not clear, however, why this construction is reserved for cases in which an idler or a pinion having a full number of teeth is employed.

In the illustration here presented, is shown a design for intermittent gears which is suitable for either light or heavy construction. An intermittent gear is bolted to each side of the worm-wheel and hub, one gear providing motion for an indexing arrangement while the other operates a clutch mechanism. These gears are made in the same manner as ordinary spur gears, except that, if necessary, calibration lugs may be cast on their rims as shown at *A*. The portions of the rims which have no teeth are cast to a smaller diameter than the root diameter of the teeth, so as to allow sufficient clearance for the pinion teeth while the intermittent spaces on the gear rotate past the pinion. This clearance may be plainly seen at *B*. The locking circle of each gear is cast integral with the gear, but is broken between the points *C* and *D* where the pinion starts and stops rotating. It is not necessary for the diameter of the locking circle to be equal to the pitch diameter of the gear; it may be made to any convenient dimension, but it is well to make this diameter as large as possible, thereby reducing any possible binding on the locking plate. It is obvious that the cutting of the gear teeth presents no difficulties, but it is sometimes necessary to reduce the addendum of the teeth adjacent to points *C* and *D* so that they will enter and leave the pinion teeth without interference. The locking plates *E* and *F* are secured to the pinion shafts at the sides of the pinions by means of feather keys. Gears of this nature run smoothly, and as their manufacture offers no difficulties to the machine shop they might well be used more extensively in the design of automatic machinery.

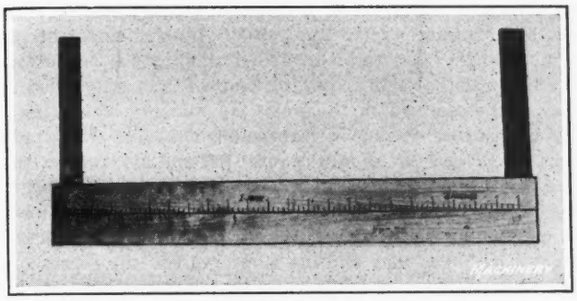



Intermittent Gears with Locking Circles

Pittsburg, Pa. N. LEERBERG

## TEACHING THE READING OF A VERNIER

The accompanying illustration shows a simple method for teaching beginners to read the vernier. The device is, in fact, a vernier on a large scale, and is made by fitting two pieces of wood together with a tongue and groove so that one will slide on the other. These pieces are made about 48 inches long, 3 inches wide, ¾ inch thick, and are fastened to two pieces at the end as shown, so that they may be hung on the wall. The upper piece is divided into two spaces of 20 inches, each space representing an inch; these two divisions are then subdivided into spaces of 2 inches, these representing tenths of an inch; and finally these subdivisions are further divided into four spaces of ½-inch each, which represent fortieths of an inch. These graduations are numbered as on a regular vernier, and the twenty-five spaces on



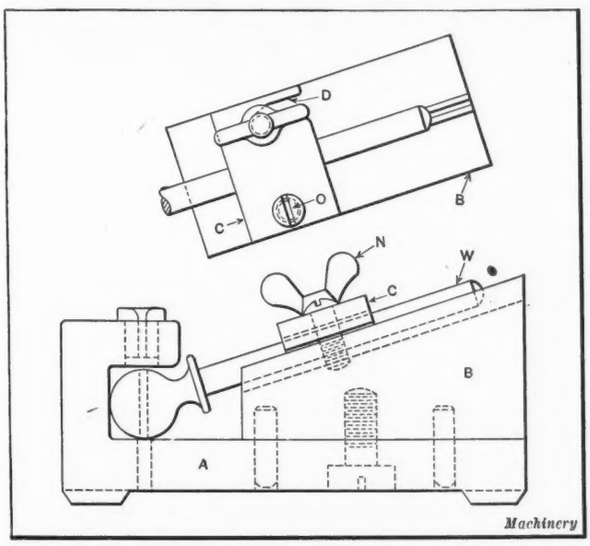
Vernier Scale to be hung on the Wall and used for Instruction Purposes

the lower piece are numbered 0, 5, 10, and so on in the regular vernier method. The device needs no further explanation, for it is obvious that it is operated by sliding the upper piece over the lower. As the lines are so far apart, no difficulty is experienced in distinguishing the correct space or line, this feature making it particularly adaptable for instruction work.

HARVEY MEAD

## JIG FOR DRILLING HOLE IN SPECIAL BOLT

The drill jig shown in the accompanying illustration is used when drilling bolts such as shown at *W*, which are employed for holding the fusilage wiring on airplanes. As shown, the hole in the ball-head is drilled on an angle. The jig consists principally of a base *A*, the end of which extends




Drill Jig for Use in drilling Special Airplane Bolts

up so that the drill bushing can be located therein in the desired relation to the head of the bolt; and a V-block *B*, which is doweled to the base, and supports the work at the desired angle. The V-block is provided with a strap *C* which holds the bolt in place by means of the wing-nut *N*. Upon releasing the wing-nut, the strap may be swung on screw *O* toward the left, provision for this movement being made by the slot *D* which permits the strap to swing and the bolt to be replaced without removing the means of holding. The construction of the jig is simple, and the results obtained by its use have been entirely satisfactory.

Roselle, N. J. CHARLES L. HILL

## GAGING LOCATED SCREW THREADS

A method of using a disk for gaging special and standard screw threads which are located an established distance from the end of the work and for gaging the templets used for inspecting the threads is presented in this article. The illustration shows a special screw thread that is to be located a distance *Z* from the end face of the piece of work. A hardened and ground steel disk having a suitable diameter is selected and applied to the work as indicated by the dotted circle. After the distance *y* has been found, the thread or templet may be gaged by applying Johansson gage-blocks between the disk and a straightedge that is placed along the end face of the piece of work.

The dimensions *A*, *B*, *W*, *R*, *m*, and *n* are known. If the angle *a* is unknown, it must be found, and for this purpose the method shown on page 978 of the June number of MACHINERY may be used. The angle *m* shown in that article when subtracted from 90 degrees will give the angle *a* in the diagram here shown. Draw *OE* and *PF* perpendicular to the side of the thread and *OD* and *PH* perpendicular to

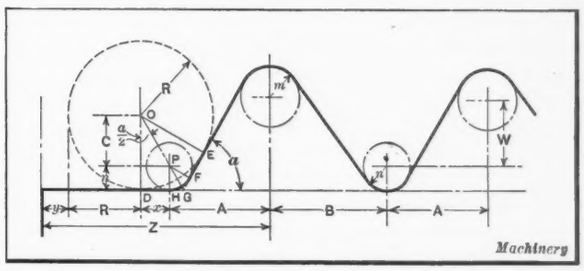



Diagram for finding Distance from End of Work to Located Thread

the axis of the thread. Then, according to a principle of geometry, angles *EOG*, *DOG*, *FPG*, and *HPG* are equal. As angles *EOD* and *FPH* are equal to angle *a*, angles *EOG*, *DOG*, *FPG*, and *HPG* equal angle $\frac{a}{2}$; also $C = R - n$. Then $\frac{x}{C} = \tan \frac{a}{2}$, or $x = C \tan \frac{a}{2}$ and $y = Z - (R + x + A)$.

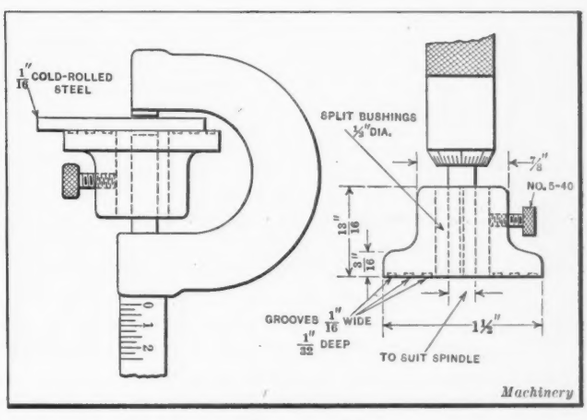
*Example*—Let $A = 0.60$ inch, $W = 0.32$ inch, $n = 0.10$ inch, $m = 0.08$ inch, $R = 0.50$ inch, and $Z = 1.50$ inch. By using the method described in the previously mentioned article, angle *a* will be found to equal 43 degrees 25 minutes 17 seconds. Then $\frac{a}{2} = 21$ degrees 42 minutes 39 seconds.

$C = R - n = 0.50 - 0.10 = 0.40$ inch. $x = C \tan \frac{a}{2} = 0.40 \times 0.39817 = 0.159268$ inch. $y = Z - (R + x + A) = 1.50 - (0.50 + 0.159268 + 0.60) = 0.2407$ inch.

West Philadelphia, Pa. ELMER LATSHAW

## LAPPING MICROMETER SPINDLES AND ANVILS

In recent numbers of MACHINERY several articles have appeared describing some very good method of lapping micrometer spindles and anvils. The illustration shows an-




Holder for Use in lapping Micrometer Spindles and Anvils, showing Method of Application

other scheme which the writer has used and which is probably as accurate as hand lapping methods can be. A holder is made from a piece of 1½-inch round brass or cold-rolled steel about ⅞ inch long. It is faced on one end and a hole is bored and reamed to receive a split bushing, the outside diameter of which is ½ inch. The bushing is bored as required to fit the micrometer spindle, which is 0.235 inch in diameter for a Starrett, 0.250 inch for a B. & S., and 0.270 inch for a Slocomb micrometer. When the holder becomes worn it may be trued up by placing it on an arbor and taking a light cut across the face. It will be noticed that dirt grooves are provided in the face of the holder for use in lapping the spindle on the lapping block. Before lapping either the anvil or the spindle, set the micrometer so as to allow about 0.0005 or 0.001 inch for lapping purposes. Lap the spindle first, holding it against the lapping block in the position shown in the right-hand view. When this is finished, replace the spindle in the micrometer and use the holder as shown at the left in the illustration, being careful to adjust the end of the spindle slightly below the upper surface of the holder. The anvil may be lapped with a perfectly flat block of 1/16-inch cold-rolled steel, using emery on the anvil side only, and oil on the holder side to insure a free and easy movement of the lap. The results may be tested from time to time without difficulty if the surfaces are properly cleaned after loosening the screw and allowing the holder to slide down on the spindle.

Hartford, Conn. WILLIAM H. MUHLEIB

## CONVENIENT METHOD OF DRAWING AN ELLIPSE

In drawing-room practice, it is frequently required to draw the projected view of a part, wherein the face or end of a cylindrical section is at an angle with the plane of the paper; or holes are required to be projected, the center lines of which lie in some other than a horizontal or vertical position in the plane of the paper. If a carefully prepared drawing is being made, it is advantageous to be familiar with some method whereby the resulting ellipse in such cases as those mentioned may be readily and correctly drawn. By referring to the diagram and following the method described, ellipses may be easily drawn.

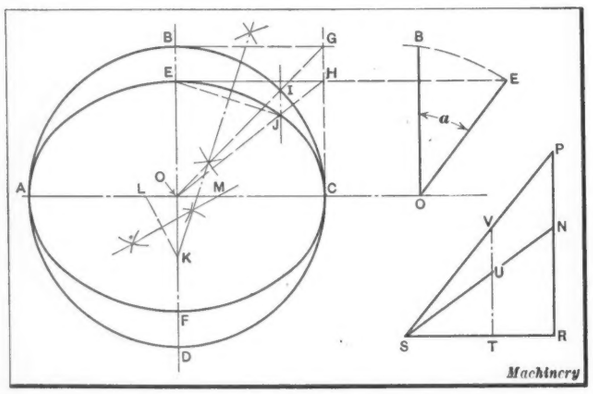



Diagram illustrating Method of drawing an Ellipse

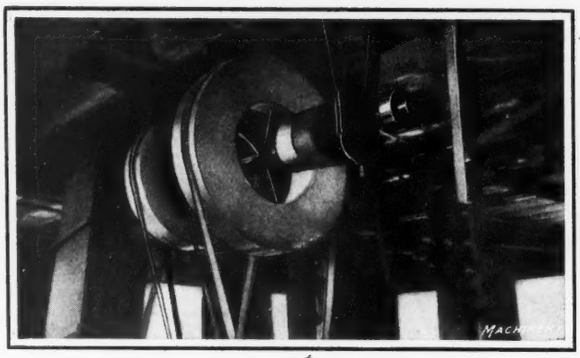
It is required to draw an ellipse resulting from inclining the circle *ABCD* at an angle *a* from the plane of the paper. Enclose the circle in a square, *BGC* being equal to one-fourth of the perimeter. Draw *GO* and project *E* to intersect *GC* at *H*. Draw *HO* and also a perpendicular from *I*, the point of intersection of *GO* with the circumference, and extend the perpendicular to intersect *HO* at *J*. The points *E*, *J*, and *C* are points on the ellipse, and through these points the two arcs which form one-quarter of the ellipse pass. The other quarters are drawn in a similar manner.

To find the centers from which these arcs are struck, draw *EJ* and bisect it, extending the line to *K* on the vertical center line. *KE* is the radius for arc *EJ*. Lay off *CL* equal to *KE*. Draw and bisect *LK*, extending the bisector to *M* on the horizontal center line. *MC* is the radius for arc *JC*. Where ellipses are formed by inclining circles of different radii, but at the same angle, the radii of the resulting ellipse may be determined in the following manner: Referring to the diagram in the lower right-hand corner of the illustration, let *RP* and *RN* equal the radii *KE* and *MC*, respectively, and *RS* the radius of the circle *ABCD*. Then, let *ST* equal the radius of any other circle inclined at the same angle, namely, angle *a*. Draw *SP* and *SN* and erect *TV* perpendicular to *RS*. The long and the short radii of the corresponding ellipse formed by inclining a circle of *RS* radius are *TV* and *TU*, respectively.

Beverly, Mass. C. O. RHYS

## BUILT-UP PULLEY CONSTRUCTION

A problem often encountered in the manufacturing field is that of providing suitable pulleys for countershafts. The high speeds required for automatic and semi-automatic machinery demand the use of either a large countershaft pulley or a high velocity, or both. Large pulleys are expensive and usually heavy; also, in order to rotate without excessive vibration, they must be in dynamic balance and the speed must not be too great. The construction of the hanger and shaft support is frequently too light to withstand much vibration. The arms of most types of pulleys create such air disturbances that it is unsafe to have the pulleys located too near the operator's head, especially if the operator is a woman.



Built-up Type of Countershaft Pulley for High Rotative Speeds

All the troubles usually found with pulleys that rotate at high speed on countershafts, such as mentioned in the preceding paragraph, were experienced by the Shann Mfg. Co., of Middletown, N. Y., until enlarged pulleys of the type shown in the illustration were used. The design of these pulleys was devised by Mr. Crawford, the head of the company, and they have been in use for such a long time without causing any trouble whatever, that they may be said to represent a new type of pulley. The pulley shown in the illustration is 32 inches in diameter and has a 4-inch face; it was built up from an iron pulley 14 inches in diameter with a 2-inch face. The enlargement is made of light-gage galvanized iron, which is securely riveted to the rim of the 14-inch pulley, and is of box construction, being light and remarkably strong. The pulley revolves at 350 revolutions per minute and carries a 1¼ inch wide shifting belt. Comparisons with the regular cast-iron pulleys show that these enlarged pulleys are preferable for light high-speed drives.

A first-class sheet-metal worker should make such a pulley in half a day. The first step is to bend and flange the rim which is next riveted to the regular pulley. The side plates are then soldered to the rim, after which the face is soldered securely to the sides. The latter constitutes the most difficult operation to be encountered in making the pulley, because it calls for what is known as "reverse flanging"; however, a skilled workman will have no trouble in this respect.

Middletown, N. Y. DONALD A. HAMPSON

# SHOP AND DRAFTING-ROOM KINKS

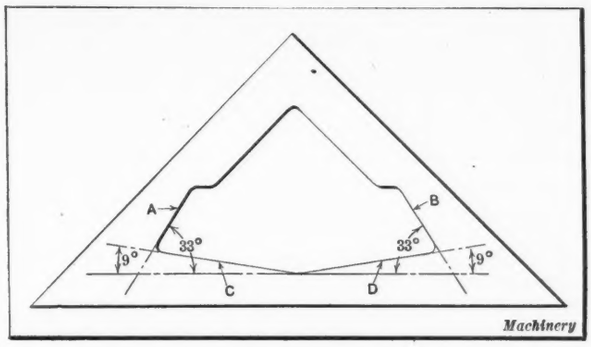
## IMPROVEMENT FOR DRIVER-PLATE OF INDEXING HEAD

When taking a second cut in milling the land on reamers or cutters, it frequently becomes necessary to turn the work slightly in order to bring it into the proper relation with the cutter. By providing an extra set-screw opposite the one furnished in the driver-plate, a fairly wide range of adjustment can be obtained without altering the position of the index crank. This idea has been found especially useful when cutting long worm screws. The work had to be turned end for end, and unless the index crank was changed, there was no other way of obtaining the adjustment necessary to bring the cutter into alignment with the previous cut, except by this method.

Milwaukee, Wis. D. E. MAPES

## DRAFTSMAN'S TRIANGLE FOR STRUCTURAL WORK

For structural work, such as large I-beams and channels, the drawing may be facilitated by cutting special angles in an ordinary 45-degree triangle, as shown in the accompanying illustration. The sides *A* and *B* were cut to a 33-degree angle from the horizontal, since the difference between 45 and 33 degrees is equal to 12 degrees—the angle of the channel leg. In like manner, sides *C* and *D* were cut to 9 degrees from the horizontal, which is the angle of the I-beam leg. This simple idea required only a small amount of work and has resulted in considerable saving of time in drafting.

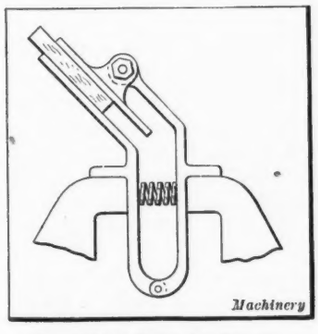



Triangle with Special Angles for Structural Work

Hamilton, Ontario, Canada A. E. KIPPS

## GAGE FILING CLAMP

The filing clamp shown in the accompanying illustration is a device commonly used by gage-makers. It is held in an ordinary bench vise, and is especially valuable for gage work or work requiring filing or beveling of the corners, as in templet work. The use of the clamp enables the gage-maker to hold and manipulate his file in a horizontal position. The upper jaw is designed to accommodate taper work when required.



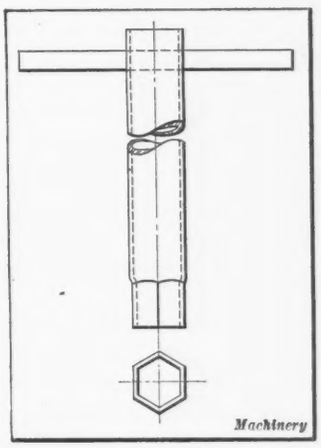

Gage Filing Clamp for Use in Bench Vise

FRED FRUHNER
Milwaukee, Wis.

## SOCKET WRENCH MADE FROM TUBING

Often when a special sized socket wrench is needed or when a standard size must be had at once, a wrench such as shown in the accompanying illustration will be found of value. Since it requires considerable time to make a wrench in the ordinary manner, the following method may be employed for such an emergency, with satisfactory results.

A piece of fairly heavy tubing, having an inside diameter approximately equal to the diameter across the corners of the nut or bolt upon which it is to be used, is selected. One end is hammered in slightly to a hexagon shape to conform to the size and shape of the nut. A handle is provided in the other end by drilling a hole in the pipe and running a rod through it. In this manner an efficient wrench is quickly made, which will be found to be as durable as some of the more elaborate types. If the correct size of tubing cannot be readily obtained, a piece of round bar stock of suitable size may be used. A hole of the required diameter is drilled into one end for a distance of about an inch, and the sides are hammered in, as in the case of the pipe.

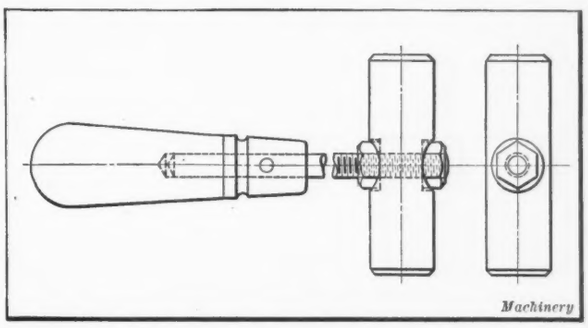



Socket Wrench made from Pipe

Baltimore, Md. S. B. ROYAL

## HAMMER WITH REPLACEABLE HEAD

The accompanying illustration clearly shows an economical and satisfactory method of making brass hammers. The head is made of stock yellow brass rod which is harder and tougher than cast brass, and hence the wearing qualities of the hammer are better than those of a cast brass hammer, while the cost of making is also diminished. As the handle is to be used permanently, it should be well made; the head may be replaced readily from made-up stock after it becomes worn. In manufacturing work, where these hammers have been used in quantities, a considerable saving has resulted.




Brass Hammer with Replaceable Head

Rockford, Ill. W. A. ANDERSON

* * *

A good cement for packing the joints of piping or vessels containing strong acid solutions is made by mixing equal parts of asbestos fiber, linseed oil, and white lead.

# HOW AND WHY

QUESTIONS ON PRACTICAL SUBJECTS OF GENERAL INTEREST

## TO REDUCE A BUSHING THAT HAS BEEN MADE OVER SIZE

R. V. L.—If a jig bushing, say ¾ inch inside diameter, has been made a few thousandths of an inch over size, how could it be heat-treated and rehardened so as to reduce it to size or a few thousandths of an inch under size?

## GRINDSTONE SPEEDS

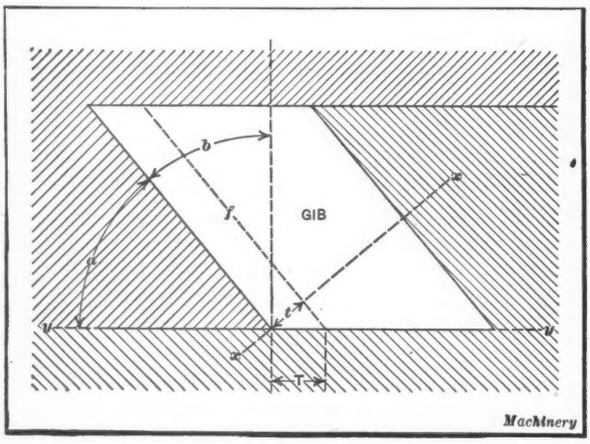
L. D.—What is the proper speed for a grindstone?

A.—The grindstones used in machine shops usually have a surface speed varying from 800 to 1000 feet per minute, although these speeds are exceeded considerably in some instances. Cutlery concerns sometimes run grindstones at 3000 or 4000 feet per minute. The safe maximum speed is difficult to determine, because stones from the same quarry vary in strength. As a rule, the speed should be limited to 2500 feet per minute, if the variety of the stone is not known.

## POSITION OF A DOVETAIL SLIDE FOR PLANING OR MILLING

S. B.—If a gib for a dovetail slide has a taper of ⅛ inch per foot, at what angle should the slide be set when planing or milling the tapering side against which the gib bears?

A.—The dotted line *f* in the accompanying illustration




Method of determining Angle to which Dovetail Slide should be set when planing or milling Tapering Side

represents the taper of the gib in a length of 1 foot. This taper will equal dimension $t$ if measured in plane $x$–$x$, and in this case is 0.125 inch. Now, in order to set the slide in the proper position on the machine, the amount of taper $T$ measured in plane $y$–$y$ is first determined and then the corresponding angle is found. This taper $T$ depends upon the angle of the dovetail and represents the taper to which the slide should be planed in order to have the outer side of the gib parallel with the opposite or straight side of the dovetailed part.

If the angle $a$ is 50 degrees, the angle $b$ equals 90–50 = 40 degrees. Having the angle $b$, the taper $T$ for a given taper $t$ equals $\frac{t}{\cos b}$. Expressing this formula as a rule, the taper for planing a dovetail to fit a tapering gib may be obtained as follows:

*Rule*—Subtract the angle $a$ of the dovetail slide from 90 degrees and find the cosine corresponding to the difference between these angles. Divide the taper of the gib by this cosine to obtain the taper of the dovetail in a plane $y$–$y$.

In this case, the angle $b$ equals 40 degrees, and cos 40 degrees equals 0.766. The taper to which the gib is planed equals 0.125 inch per foot, and 0.125 ÷ 0.766 = 0.163, which is the taper per foot in a plane $y$–$y$.

The tangent of the angle corresponding to the taper per foot may be found by dividing the taper in inches per foot by 12. In this case, the taper per foot of the dovetail slide is 0.163 inch when measured parallel to the flat bearing surfaces. At what angle should the slide be set for planing or milling that side against which the gib bears? The tangent of the angle equals 0.163 ÷ 12 = 0.0136, which is the tangent of 47 minutes or nearly 5/6 degree. Therefore, one side of the slide should be set as nearly as possible to this angle when machining the opposite or gib side. It will be understood that the angular position of the slide when being planed or milled is relative to the travel of the table.

## "ABSOLUTE" AS APPLIED TO VELOCITY, PRESSURE AND TEMPERATURE

A. G.—What is meant by absolute velocity, absolute pressure, absolute temperature, and absolute zero, as these terms are used in mechanics?

A.—Velocity may be either absolute or relative. The absolute velocity of a moving body is its velocity with reference to some object which is considered completely at rest. In practical mechanics, the earth is assumed to be stationary, so that the velocity of any moving body, such, for example, as a moving train with relation to the rails, would be absolute velocity. The term "absolute velocity" is used in contradistinction to "relative velocity," which is the rate of motion of a body with relation to another moving body. The piston as it moves in the cylinder of a locomotive has a relative velocity with reference to the cylinder wheels, but its absolute velocity is its rate of motion with reference to the rails, and equals the velocity of the train plus or minus the relative velocity of the piston with reference to the cylinder. The relative velocity is added to the train velocity when the piston moves in the same direction as the train, and is subtracted when it moves in the opposite direction.

Absolute pressure is the pressure on any surface including the atmospheric pressure. The pressure of air, gases, or fluids may be measured in *absolute* or in *gage* pressure. The gage pressure is the pressure above that of the atmosphere, while the absolute pressure includes the pressure of the atmosphere. The pressure of the atmosphere at sea level may be assumed as 14.7 pounds per square inch; hence, absolute pressure may be transformed into gage pressure by subtracting 14.7 from the absolute pressure, and, inversely, gage pressure may be transformed into absolute pressure by adding 14.7 to the gage pressure.

Absolute temperature is a temperature reckoned from the absolute zero instead of from the zero on the thermometer scale. To find the absolute temperature when the temperature in degrees F. is known, add 460 to the number of degrees F. for the Fahrenheit scale, and 273 to the number of degrees C. for the Centigrade scale. For example, the absolute temperature of the freezing point of water is 460 + 32 = 492 absolute temperature F., or 273 + 0 = 273 absolute temperature C.

Absolute zero is a point determined on the thermometer scale by theoretical considerations, beyond which a further decrease in temperature is inconceivable, and is located at 273 degrees C., or approximately 460 degrees F.

## FORMING DEEP CORRUGATIONS

H. A. A.—Corrugated parts similar to the one illustrated in the June number of MACHINERY, page 978, are required in large quantities. How can they be produced? Copper having a thickness of about 1/64 inch is to be used.

ANSWERED BY R. P. DEANE, HOLYOKE, MASS.

The parts might first be spun from seamless copper tubing on a sectional chuck or arbor, similar to the one shown in

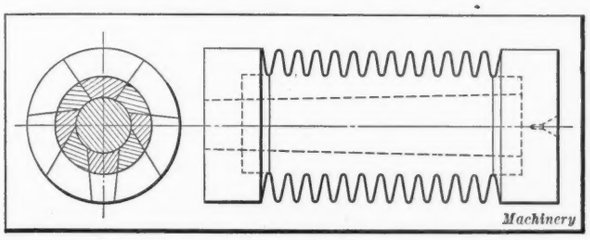



**Fig. 1. Sectional Chuck for spinning Copper Tubing when making Deep Corrugations**

Fig. 1, held in a lathe chuck. After the piece is spun and trimmed, the distances between the corrugations may be closed to form the desired shape by means of a die constructed as shown in Fig. 2. This die consists of a two-piece, hinged, cylindrical clamp *A*, each half having two lips *B* to keep the split washers *C* in alignment with each other. These washers are cut away at *E* so that when the die is closed around the work after it has been placed on the bolster of the press, and the springs *F* have been compressed by punch *H* as it descends, the thin part of the washers will act as a gage for the width to which the corrugations are to be closed. The full thickness of the washers should be such as to bring the piece to the right length when it is compressed.

When the die is open and the work removed, the washers are held apart by means of the flat springs *F*, which are

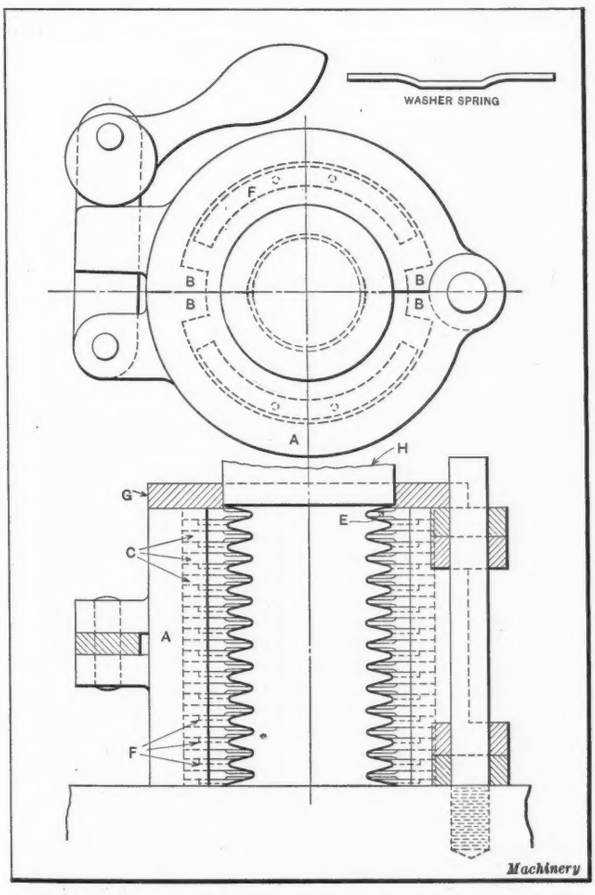



**Fig. 2. Hinged Die for holding Tubing while the Spun Corrugations are being closed**

riveted to the top side of each washer and bent to the shape shown in the illustration. By this arrangement, a spring is interposed between each half-washer. A plate *G* is employed to keep the washers and springs spaced to the proper length so that when the die is closed, the thin part of the washers will enter the corrugations. The punch *H* is flat on the end, and is made to the diameter of the finished piece. The press would need to be carefully set for height in performing this work, because if the stroke should be too long, the thin section of the split washers would be in danger of becoming punched out.

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## PRODUCTION PROBLEM FOR THE MACHINE SHOP

M. M. S.—What is the best method to employ, on a production basis, in removing stock from a wrench head in which the movable jaw of the wrench operates, as shown in the illustration on page 1086 in the July number of MACHINERY? The stock removed forms a slot which cuts into the previously drilled hole for the jaw rack.

ANSWERED BY DONALD A. HAMPSON, MIDDLETOWN, N. Y.

The preferable method to employ in machining this part in quantities is largely a matter of opinion and depends upon the circumstances that prevail in the shop where the

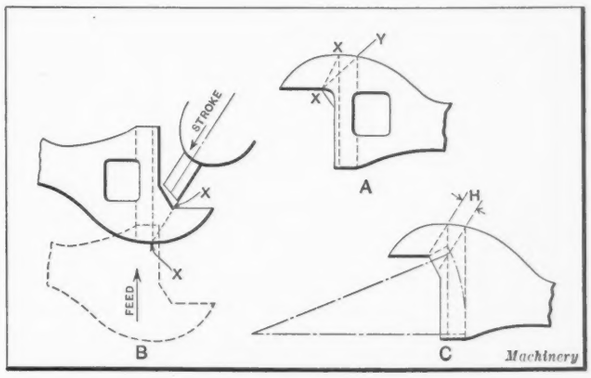



**Fig. 1. (A) Suggested Change in Design of Wrench Head. (B) Die-slotter Method. (C) Performing the Operation on a Slot Milling Machine**

work is to be performed. There are various ways in which the machine operation could be done, each of which would yield approximately the same hourly production. The selection of the most economical method should be governed by such factors as the following: Whether the existing equipment is to be used, or whether new machinery should be purchased or special machinery built; how many parts are to be produced; and whether or not the work can best be completely machined in a single operation.

From a manufacturing standpoint, two changes in design of the part might be made, each of which would somewhat lessen the difficulty of machining the piece; moreover, these changes would not weaken the wrench and probably would not affect its general construction. The angle formed by the surface *XX*, Fig. 1, diagram *A*, might be changed to that represented by *XY*, so as to obviate removing the stock between these two planes, or if the surface *XX* could be left half-round instead of flat, it would allow the use of a drill or end-mill for removing the stock, and no subsequent operation would be necessary.

### Die-slotter Method

The die-slotting machine is probably the only machine in which the work can be performed in a single operation and strictly according to requirements. The tool-head is set at an angle as shown in diagram *B*, and the stroke of the machine is set to over-run length *XX*, enough for a working clearance. The cut should start at the top of the piece and continue to the position shown in the illustration, when the feed should be automatically stopped. A high cutting speed, light feed, and a copious supply of coolant should be used.

Power vertical feed should be provided so as to permit feeding with a clean, even cut without gouging in. The use of power feed also enables a double holding fixture to be employed, one holder of which may be loaded while the other is under the cut, thus producing practically a continuous output.

### Performing the Operation on a Slot Milling Machine

Diagram *C* shows how the work would be performed on a slot milling machine of the type in which the mill swings in an arc of a circle as it revolves. The hole *H* is first drilled at the proper angle, using a drill having a diameter equal to the width of the slot to be cut. The wrench is then clamped in the fixture in such a position that the arc described by the traverse of the milling cutter will clean out all the stock. If the half-round surface made by the drilled hole *H* is not broached flat, the movable jaw can readily be forged to fit the semicircular surface. If the angle of surface *XX* were changed, as previously suggested, it would not be necessary to drill hole *H*, in which case the stock could be completely removed in one operation.

### How the Work Could be Done without Using Special Equipment

If it were required to produce the work without special machines, it is probable that with ordinary shop tools in good condition, satisfactory results could be obtained as follows: Referring to diagram *A*, Fig. 2, first, using a drill of larger diameter than that of the angular hole, spot the forging as shown, the work being held in a fixture having spring locating sides to steady the work. The piece would then be placed in the position shown at *B* and the angular hole drilled, using hand feed. The drill spot previously made produces an approximately flat surface for the drill to start on, insuring more accurate location of the hole and decreased wear of the drill bushing. The third operation consists of drilling the rack hole from the opposite side of the wrench head. It is evident that the reason for this procedure is that the rack hole, being larger and longer than the angular hole, will not be affected by striking the smaller hole. On account of breaking into the smaller hole and also into the opening for the worm, power feed should be used. Finally plane out the section *S* as shown at *C* by using a shaper and standard cutting-off blade as a tool, for which a special toolpost should be made. A fixture for holding the jaw at the angle shown would also be required. For this

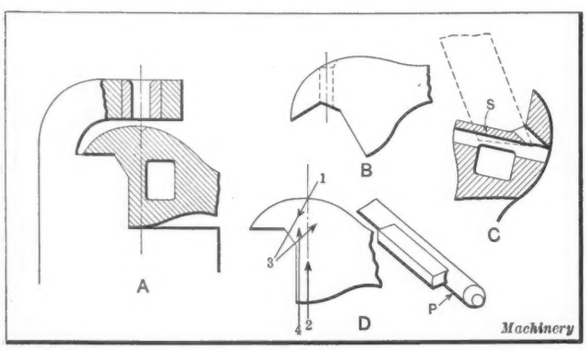
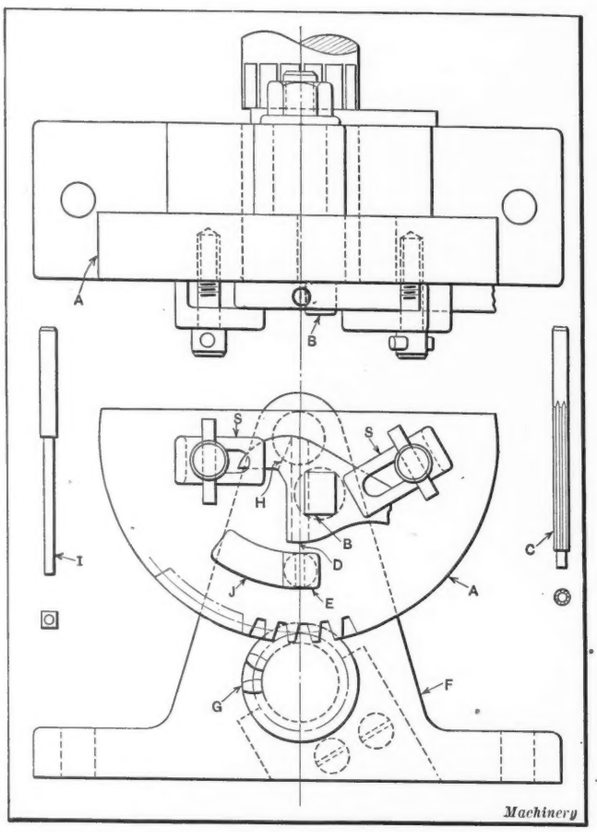



Fig. 2. Diagrams illustrating Methods of machining Slot in Wrench Head without using Special Machines

operation, stops should be provided to limit the vertical movement of the tool, and power feed should be employed or some device should be used to prevent breakage of the tool caused by too heavy a feed.

### Removing All the Stock by Drilling

The wrench slot may be produced by the all-drilling method, as shown by the diagram *D*, which indicates the order in which the holes are drilled and the direction of cut. The piloted punch or broach *P* is employed to clean out the slot, the work being performed on an arbor press.




Special Milling Fixture for machining Wrench Head Slot

The advantage of this method lies in the small investment required and the fact that the tools used are easily obtained and inexpensive.

ANSWERED BY EDMUND C. PERSANS, BROOKLYN, N. Y.

The slot for the movable jaw may be machined by milling, using a vertical milling machine and a fixture designed as shown in the accompanying illustration. The wrench head is attached to a semicircular plate *A* by means of the straps *S*, and is located by means of the stud pin *B*, which enters the worm hole in the wrench head and which is a driving fit in the plate *A*. With the fixture in the position shown and the work in place, a cutter *C* of the required diameter is placed in the chuck, and allowed to drop down within the hole *D* in the jaw until its pilot enters a hole in the square post *E*. This post is stationary in the base and extends through an arc-shaped slot *J* in plate *A*, in which it should be a working fit. Provision is thus made to strengthen and support the long slender cutter and also to allow the work-holding plate to be partly revolved, as required in the performance of the operation. The plate *A* is swung on its axis by means of pinion *G*, which meshes with teeth on the plate, thus feeding the work against the cutter until the line *H* is reached. A worm and worm-wheel would probably furnish a better feeding arrangement than the gear and pinion shown.

If a square-cornered slot is essential, the slot could be broached at the same setting in the milling machine by replacing the milling cutter with a square broach *I* having a long pilot which would fit into the hole in post *E* and guide the tool in the proper direction during the operation.

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## DEFINITION OF AUTOMATIC MACHINE

**A. R. S.—There seems to be some difference of opinion as to what constitutes an automatic machine, if one may judge from the use of this term by manufacturers. What are the distinctive features of an automatic machine?**

**A.—Machines capable of producing duplicate parts automatically without the assistance of an operator—except when**

supplying the machine with new material or when readjusting it—are universally known as automatic machines. A type of machine, however, which simply performs a complete cycle of operations and then requires the attention of an operator each time a part is finished, is called an automatic machine by some manufacturers and semi-automatic by others. A machine of this class is really semi-automatic, because it is not capable of reproducing duplicate parts without the attention and assistance of an operator. For instance, if a machine tool is designed to control the movements of all cutting tools automatically, but must have the work released from, and inserted into, the chuck by hand after the machining operation on each piece is completed, it is semi-automatic. But if the same machine is equipped with some form of attachment that enables the chucking to be done mechanically, it becomes an automatic machine. Sometimes machines that are really semi-automatic are referred to as automatic, and other machines that are capable of continuous operation are called fully automatic in order to distinguish them from the other class.

## SEMI-STEEL

F. L.—What is semi-steel and how is it produced? What are the semi-high-speed or intermediate steels?

A.—Semi-steel, as it is called, is produced practically the same as cast iron, in that a cupola is used for melting the charge and the molten metal is poured into molds, but the charge contains 20 per cent or more of steel scrap and the castings have a comparatively fine grain, so that they are often used for parts requiring a good appearance or greater tensile strength and ability to resist shocks than ordinary castings. The tables, slides, and large gears for machine tools are often made of semi-steel.

The so-called "semi-high-speed" steel was produced to meet the demand for a steel which could be used just as well as high-speed steel for certain purposes, and still be much lower in price. The quality of this steel, as far as cutting speed is concerned, is somewhere between ordinary carbon steel and the modern high-speed steel. It contains a much smaller percentage of tungsten than regular high-speed steels, and is sometimes called a low-tungsten steel.

## DIAMETER AND THROAT RADIUS OF A WORM-WHEEL BLANK

C. W.—A worm-wheel having 45 teeth is to be driven by a double threaded worm having an outside diameter of 2½ inches and a lead of 1 inch, the linear pitch being ½ inch. How are the throat diameter and throat radius of the worm-wheel determined, and also the angle at which the worm-wheel blank should be set on the milling machine when gashing it preparatory to the hobbing operation?

A.—The throat diameter is found by adding twice the addendum of the worm thread to the pitch diameter of the worm-wheel. The addendum of the worm thread equals the linear pitch multiplied by 0.3183, and in this case is $0.5 \times 0.3183 = 0.1591$ inch. The pitch diameter of the worm-wheel is obtained by multiplying the number of teeth in the wheel by the linear pitch of the worm, and dividing the product by $3.1416 = 45 \times 0.5 \div 3.1416 = 7.162$ inches. Hence, the throat diameter equals $7.162 + 2 \times 0.1591 = 7.48$ inches.

The radius of the worm-wheel throat is found by subtracting twice the addendum of the worm thread from ½ the outside diameter of the worm. The addendum of the worm thread equals 0.1591 inch, and the radius of the throat, therefore, equals $(2.5 \div 2) - 2 \times 0.1591 = 0.931$ inch.

When a worm-wheel is hobbed in a milling machine, gashes are milled before the hobbing operation. The table must be swiveled around from its right-angle position while gashing, the amount depending upon the relation between the lead of the worm thread and the pitch circumference. The first step is to find the circumference of the pitch circle of the worm. The pitch diameter equals the outside diameter minus twice the addendum of the worm thread. Hence, the pitch diameter equals $2.5 - 2 \times 0.1591 = 2.18$ inches, and the pitch circumference equals $2.18 \times 3.1416 = 6.848$ inches. As the worm is double-threaded, the lead equals 2 times the pitch, or 1 inch. After determining the lead and the pitch circumference, the angle to which the table of the machine should be set is found as follows: Divide the lead of the worm thread by the pitch circumference to obtain the tangent of the desired angle, and then refer to a table of tangents to determine what this angle is. In this case it is $1 \div 6.848 = 0.1460$ which is the tangent of 8 1/3 degrees, nearly. Therefore, the table of the milling machine is set at an angle of 8 1/3 degrees from its normal position.

## FINDING THE LENGTH OF THE RADIUS OF A TANGENT ARC

E. E. J.—How can the length of the radius of a tangent arc for a slabbed cylindrical piece be found if the radius $R$ of the piece, the angle $a$ at which the slab is taken, and the distance $Y$ are known?

ANSWERED BY ELMER LATSHAW

A solution of this problem which appears simpler than that given on page 1086 of the July number, is as follows: Referring to the accompanying diagram, draw $CE$ parallel to $BO$; also draw $ED$ parallel to $CB$.

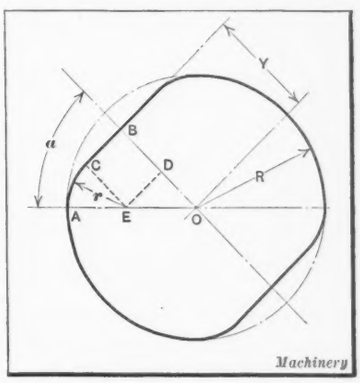


Diagram for finding the Length of the Radius of a Tangent Arc

Then

$$r = CE = AE = BD$$

$$OD = Y - r;\ OE = R - r$$

Hence

$$\frac{Y - r}{R - r} = \cos a$$

$$(R - r)\cos a = Y - r$$

$$r - r\cos a = Y - R\cos a$$

$$r = \frac{Y - R\cos a}{1 - \cos a}$$

[The above solution of the problem was also submitted by Max Silver, Plainfield, N. J., and by George Warmington, Beverly, Mass.]

### CORRECTION

In the article entitled "Finding the Length of the Radius of a Tangent Arc" which appeared on page 1086 of the July number, the last three equations should have read:

$$DA = \left(\frac{Y}{\cos a} - R\right)\tan\ (90\ \text{deg.} - a)$$

$$r = \frac{[(Y \div \cos a) - R]\tan\ (90\ \text{deg.} - a)}{\tan\ \frac{a}{2}}$$

$$r = \frac{[(Y \div \cos a) - R]\cot a}{\tan\ \frac{a}{2}}$$

* * *

According to the *Iron Age*, a large valve foundry in Troy, N. Y., which had been paying its workmen $5.40 daily for nine hours' work, made an agreement with the employes to pay them $6 a day and shorten the day to eight hours, promising to maintain these rates provided the men produced as much as under the old system.

## DRILLING RECORDS

One of the interesting features of this year's convention of the American Railroad Association (Mechanical Section) at Atlantic City, was the demonstrations of machines and tools. In fact, those who have attended similar conventions for many years agreed that the exhibits were exceptional. One of the unusual features of these exhibits was the demonstration of high-speed drilling in cast iron and steel. The records which follow have been submitted by the Whitman & Barnes Mfg. Co., Akron, Ohio, and represent the work of this company's "Hercules" high-speed steel drills. The class of drilling machine used in each case is given, and also the name of the manufacturer.

*Demonstration 1*—Machine, six-foot radial; manufacturer, American Tool Works Co., Cincinnati, Ohio; material drilled, 2½ inches of cast iron; drill diameter, 2 inches; speed, 500 R. P. M.; feed, 0.040 inch per revolution; number of holes drilled, 6; rate of drilling, 20 inches per minute; time per hole, about 7 seconds.

*Demonstration 2*—Machine, same as in preceding paragraph; material drilled, 6-inch forged steel block containing 0.50 per cent carbon, 1 per cent nickel, and 0.75 per cent manganese; drill diameter, 2 inches; speed, 183 R. P. M.; feed, 0.022 inch per revolution; rate of drilling, about 4 inches per minute, four holes being drilled before dulling the drill.

*Demonstration 3*—Machine, three-foot radial; manufacturer, American Tool Works Co.; material drilled, 2½ inches of cast iron; drill diameter, 1 inch; speed, 700 R.P.M.; feed, 0.026 inch per revolution; rate of drilling, 18.2 inches per minute; number of holes drilled, 21, with drill in good condition after completing the work.

*Demonstration 4*—Machine, drilling machine of the all-geared type; manufacturer, Barnes Drill Co., Rockford, Ill.; material drilled, cast-iron block 2 inches thick; drill diameter, 1 1/16 inch; speed, 233 R.P.M.; feed, 0.093 inch per revolution; rate of drilling, 21.6 inches per minute; number of holes drilled, 9, without injuring the drill.

*Demonstration 5*—First Test: Machine, six-foot radial; manufacturer, American Tool Works Co.; material drilled, forged open-hearth steel block 3 inches thick, containing 0.40 per cent carbon; drill diameter, 1 inch; speed, 444 R.P.M.; feed, 0.022 inch per revolution; rate of drilling, about 9.8 inches per minute, or 20 seconds per hole; number of holes, 3. Second Test: Speed, 500 R.P.M.; feed, 0.029 inch per revolution; rate of drilling, 14½ inches per minute, or 15 seconds per hole; number of holes, 3. Third Test: Speed, 500 R.P.M.; feed, 0.040 inch per revolution; rate of drilling, 20 inches per minute, or 9 seconds per hole. Note: The drill broke on the fourth hole because the lubricant pipe was pushed out of the way by the drill chips.

*Demonstration 6*—Machine, same as in preceding paragraph; material drilled, forged steel block 6¼ inches thick, containing 0.50 per cent carbon, 0.75 per cent manganese, 1 per cent nickel, and a small amount of chromium; drill diameter, 2 inches; speed, 183 R.P.M.; feed, 0.022 inch per revolution; number of holes drilled, 14.

*Demonstration 7*—Machine, high-duty drilling machine; manufacturer, Defiance Machine Works of Defiance, Ohio; material drilled, 3-inch forged steel block containing 0.50 per cent carbon, 1 per cent nickel; drill diameter, 1 3/16 inch; speed, 408 R.P.M.; feed, 0.018 inch per revolution; average number of holes per grinding, 21.

*Demonstration 8*—Machine, six-foot radial; manufacturer, Western Machine Tool Co., Holland, Mich.; material drilled, 6-inch forged steel block containing 0.50 per cent carbon, 1 per cent nickel, 0.75 per cent manganese; drill diameter, 1½ inch; speed, 192 R.P.M.; feed, 0.018 inch per revolution; number of holes drilled, 19.

*Demonstration 9*—Machine, high-duty drilling machine; manufacturer, Defiance Machine Works; material drilled, 3-inch forged steel block containing 0.50 per cent carbon and 1 per cent nickel; drill diameter, 2½ inches; speed, 126 R.P.M.; feed, 0.018 inch per revolution; number of holes drilled per grinding, 26.

*Demonstration 10*—Machine, six-foot radial; manufacturer, American Tool Works Co.; material drilled, 6-inch forged steel block containing 0.50 per cent carbon, 0.75 per cent manganese, 1 per cent nickel, and a small amount of chromium; drill diameter, 4 inches; speed, 96 R.P.M.; rate of drilling, 1½ inch per minute. Note: The same drill also drilled a 3-inch block with a feed of 0.022 inch per revolution.

*Demonstration 11*—Machine, same as in preceding paragraph; material drilled, forged steel block 3⅛ inches thick, containing 0.50 per cent carbon, 0.75 per cent manganese, 1 per cent nickel, and a small amount of chromium; drill diameter, 2 inches; speed, 183 R.P.M.; feed, 0.022 inch per revolution; number of holes drilled, 41, having a depth of 3⅛ inches, giving a total of 128 inches without grinding, and at the rate of about 45 seconds per hole. Note: This performance is considered remarkable in view of the size of the drill and the nature of the material drilled.

*Demonstration 12*—Machine, six-foot "triple-purpose" radial; manufacturer, American Tool Works Co.; material drilled, forged steel block 6¼ inches thick, containing 0.50 per cent carbon, 1 per cent nickel, and a trace of manganese; drill diameter, 2 inches; speed, 206 R.P.M.; feed, 0.040 inch per revolution; rate of drilling, 8¼ inches per minute.

*Demonstration 13*—Machine, six-foot radial; manufacturer, American Tool Works Co.; material drilled, forged steel block 6¼ inches thick, containing 0.50 per cent carbon, 0.75 per cent manganese, 1 per cent nickel, and a small amount of chromium; drill diameter, 3 inches; speed, 109 R.P.M.; feed, 0.022 inch per revolution; rate of drilling, 2.4 inches per minute.

* * *

## INDUSTRIAL IMPORTANCE OF THE MOONEY CASE

In view of the fact that a nation-wide strike was once threatened as a protest against the conviction of Thomas J. Mooney, every employer, as well as every labor union member, should be interested in obtaining as complete information as possible concerning the facts in the case, because it is of the greatest importance to the whole industrial world that the facts in the Mooney case be known. The most complete review that has been made of the case is that which has just been prepared and published by John M. Olin, a well-known lawyer of Madison, Wis. In view of the fact that the newspaper accounts of the conditions surrounding the Mooney case have been both incomplete and contradictory, the book by Mr. Olin, entitled "Review of the Mooney Case," will prove of the greatest value and interest both to employers and employes interested in industrial peace and fair play. The author of the book is universally recognized in his state as a lawyer and citizen of the very first rank, and is president of the Bar Association of Wisconsin. What Mr. Olin has to say concerning the Mooney case will be entitled to the serious consideration of anyone desirous of learning the facts with regard to a matter that threatened the industrial peace of the whole nation. Copies of the book can be obtained free of charge by addressing John M. Olin, Madison, Wis.

* * *

Thirty years ago, the Bourne Mills, Fall River, Mass., inaugurated a profit-sharing plan under which the fifty-ninth profit-sharing dividend has just been distributed to the employes, which amounted to 4½ per cent on the wages paid for the last six months. This dividend is paid to all employes who have been with the company for a full six months' period. The plan was inaugurated by George Chase, first treasurer of the company. In view of the fact that the application of profit-sharing systems has aroused considerable discussion of late, it is of interest to note that a profit-sharing plan has been in effect for so many years.

# NEW MACHINERY AND TOOLS

THE COMPLETE MONTHLY RECORD OF NEW AMERICAN METAL-WORKING MACHINERY

The New Tool Descriptions in MACHINERY are restricted to the special field the journal covers—machine tools and accessories and other machine shop equipment. The editorial policy is to describe the machine or accessory so as to give the technical reader a definite idea of the design, construction, and function of the machine, of the mechanical principles involved, and of its application.

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## Daniels Automatic Lathe

THE Rockford Machine Tool Co., Rockford, Ill., is now building an automatic lathe which is here illustrated and described. It is known as the Daniels automatic lathe because the machine was designed by Lee G. Daniels of Rockford. This machine is intended for the rapid production of duplicate parts and the aim of the designer has been to provide for saving as much of the operator's time as possible, and to provide a sufficiently heavy construction to enable the lathe to be operated at a high speed and under a heavy rate of feed. In machining duplicate parts on the Daniels lathe, the work is either centered or mounted on an arbor, so that it may be set up between centers. When the work is in place, the speed clutch is engaged and the feed-worm is lifted into the operating position. Both feeds are started in this way and they continue to operate until the side carriage automatically trips the feed in a predetermined position, after which all tools return to the starting point. Then it is necessary for the operator to disengage the speed clutch and remove the finished work so that a fresh blank may be set up in its place. Where it is only necessary for an operator to pay this small amount of attention to the work, it is possible for him to attend to two or more machines. The side and right angle carriages are arranged to carry multiple tools, the side carriage being used for turning different diameters while the right angle carriage is utilized for the performance of facing and recessing operations. It is entirely practicable to use four or more tools on each carriage with all of them operating at the same time.

*This is a production machine for use in the manufacture of duplicate parts. The speed and feed are made suitable for the work on which the lathe is to be used, and no mechanical changes are provided. When the feed movements are automatically stopped, the carriage is withdrawn from the operating position, so that the finished surface is not marred while the tools are being returned to the starting point.*

There are no mechanical changes of speed and feed because this is a production machine, and it is arranged to be driven at the speed and feed which are most suitable for the work on which the lathe is to be used. Change-gears can be used to vary the rate of feed; and to adjust the speed it would be necessary to change the overhead pulley. Such changes are only necessary when the machine is to be used on a different class of work from that on which it was formerly employed. The drive is transmitted to a friction pulley and thence through a pair of helical gears to the spindle, this arrangement giving a smooth and power-

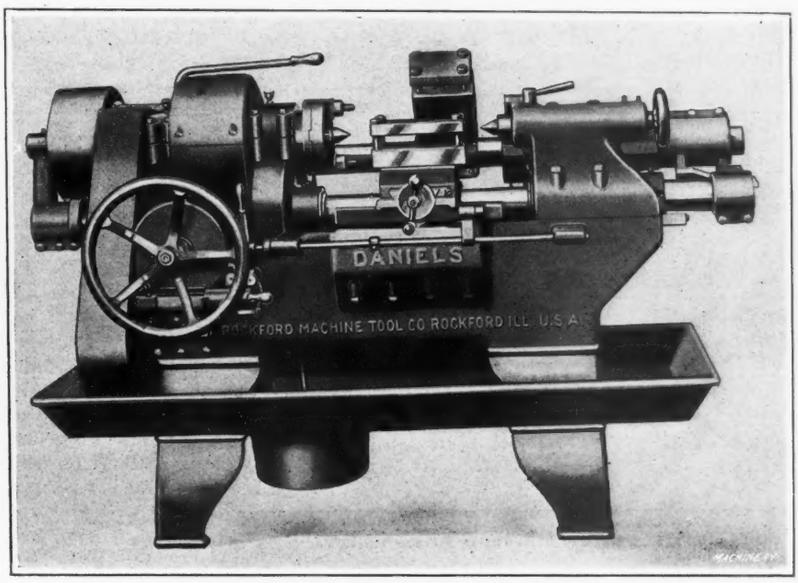



**Fig. 1. Daniels Automatic Lathe built by the Rockford Machine Tool Co.**

ful drive. It will be noticed that the headstock is cast in one piece with the bed. A departure from established practice has been made by supporting the side carriage on a heavy steel bar instead of having it carried on ways. This bar has a bearing in the headstock and tailstock, and the carriage is firmly clamped to the bar. At the front of the bed, the carriage has a bearing on a hardened steel way. When the feeds are disengaged, the carriage is automatically withdrawn from the work, so that the tools will not mar the finished surface while returning to their starting position.

If so desired, a master form may be substituted for the hardened steel way which supports the carriage, in order to finish the work to a tapered or to a convex or concave form. The right-angle carriage is mounted on a bar support in bearings cast integral with the headstock and tailstock, and it is in perfect alignment with the spindle. A segment cam on this bar is actuated by means of a roller from the side carriage bar. It will be seen that a four-bolt type of tailstock is used on this machine, the tailstock bearing on the bed being fitted with a tapered gib to afford convenient means of adjustment and compensation for wear. The regular equipment furnished with this machine includes an oil-pump which is driven by chain from the clutch shaft. This pump is provided with flexible tubing for delivering a copious flow of coolant to the work.

Principal dimensions of the Daniels automatic lathe are as follows: Swing over side carriage bar, 14 inches; swing over cross carriage, 10½ inches; distance between centers, 18 inches; travel of side carriage, 12 inches; dimensions of front spindle bearing, 4⅝ inches in diameter by 6⅜ inches in length; dimensions of rear spindle bearing, 3½ inches in diameter by 5 inches in length; diameter of hole through spindle, 1½ inch; diameter of spindle nose, 3⅝ inches; length of spindle nose, 2⅝ inches; diameter of tailstock spindle, 2⅞ inches; diameter of driving pulley, 14 inches; width of driving belt, 6 inches; pitch of helical teeth on driving gears, 6/8 stub tooth; face width of spindle driving gears, 4¾ inches; ratio of reduction from driving pinion to gear, 4 to 1; and weight of machine, 3500 pounds.

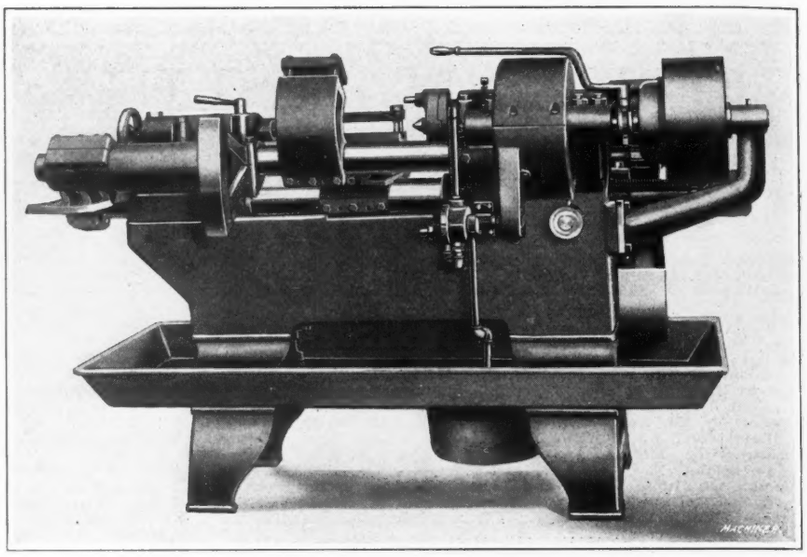
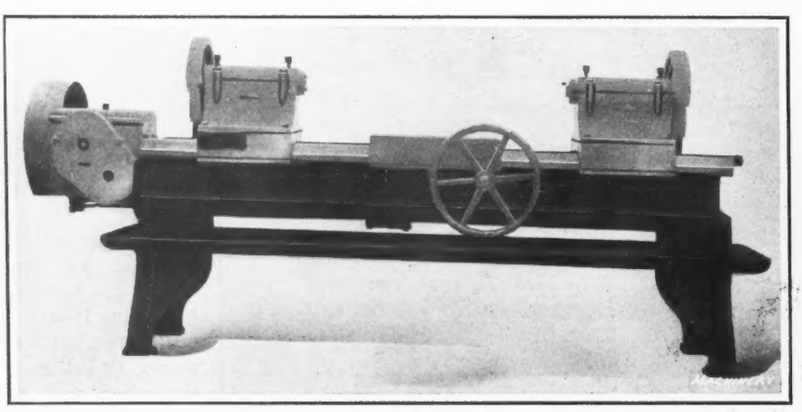


Fig. 2. Rear View of the Daniels Automatic Lathe

## MUNSON BORING, FACING AND TAPPING MACHINE

The Munson Mill Machinery Co., Inc., Utica, N. Y., is now building a horizontal opposed-spindle boring, facing, and tapping machine which is especially adapted for machining parts that have holes in opposite sides, which must be in alignment. Rear-axle housings and transmission cases for motor cars are typical examples of the work which may be advantageously handled on a machine of this type. It will be apparent from the illustration that, in general appearance, this machine is somewhat similar to a lathe as it has the same bed, legs, chip pan, etc. A stationary carriage is secured to the middle of the bed and two tool-heads are mounted on ways at each side of the carriage. These heads are fed toward the work mounted on the carriage by a right- and left-hand lead-screw mounted at the center of the bed, which is driven through a gear-box at the left-hand end of the machine. Provision is made for controlling the lead-screw by two levers which are conveniently located near the center of the machine; one of these levers controls a rocking bracket that swings a worm into engagement with a worm-wheel for the power feed, and the other lever changes from power feed to a positive tapping lead, or vice versa.

When the mechanism controlled by these levers is thrown out of engagement, a hand-operated quick return of the carriage is available, this movement being obtained by turning the large handwheel, which will be seen at the right-hand end of the carriage. It will be apparent that this is a manufacturing machine, and after it has once been set up, it is likely to operate on one job for a considerable length of time. Therefore, only one rate of power feed and one tapping lead have been provided, and the spindle speed is similarly arranged. By changing one gear in either drive, a suitable rate of feed or tapping lead may be obtained for the particular job on which the machine is to be used.



Opposed-spindle Boring, Facing, and Tapping Machine built by the Munson Mill Machinery Co.

## LAVOIE AIR CHUCK

The Lavoie air chuck, manufactured by the Frontier Chuck & Tool Works, 30 Letchworth St., Buffalo, N. Y., has the complete chucking and operating mechanism forming a single unit. It can be installed directly on the end of the spindle or removed as readily as any ordinary chuck. Having reversible jaws and adjusting screws, it is operated independently by hand and universally by air. The mechanism is of simple design, there being but one packing and no gears. The range of sizes is from 3 inches to 48 inches and the styles in accordance, to suit an extremely wide range of chucking work.

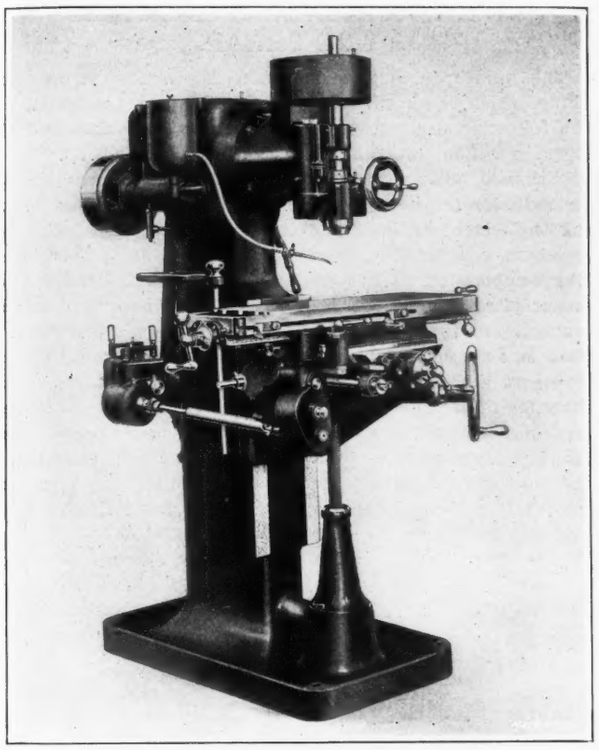


Fig. 1. Plain Vertical Miller built by the Cochrane-Bly Co.

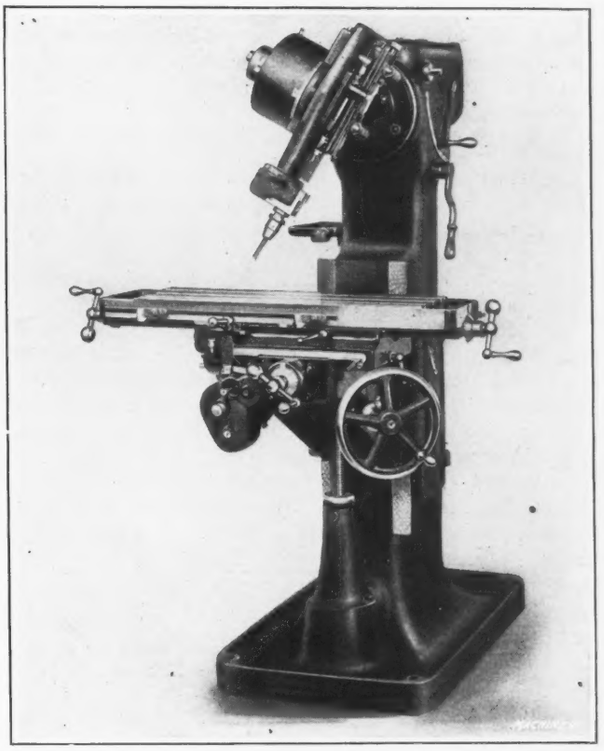


Fig. 2. Universal Vertical Shaper built by the Cochrane-Bly Co.

## COCHRANE-BLY MILLERS AND SHAPERS

*These simplex machines are of similar design to the duplex miller and shaper which has been built for several years by the Cochrane-Bly Co. Simplex millers are made with both plain and universal heads, but the simplex shapers are only made with universal heads. A circular table with a dividing attachment and a compound circular table are made for use on these machines, and add greatly to the range of work for which they are adapted.*

For several years the Cochrane-Bly Co., Rochester, N. Y., has been building a duplex universal miller and shaper. This machine was fully illustrated and described in the New Machinery and Tools section of MACHINERY for October, 1912, but several modifications have recently been made in the machine which is now being built with single heads, so that it is obtainable as a universal vertical miller, a universal vertical shaper, or a plain vertical miller, in addition to the duplex universal vertical miller and shaper. The universal head on both the duplex and simplex machines adjusts right to left or left to right through a full circle, and the shaping and milling heads may be adjusted independently front and back up to 40 degrees, these heads being operative in any position.

### Features of the Milling Machines

An adjustment of 3½ inches is provided for the milling spindle with hand feed, and a micrometer screw is provided on the spindle housing to gage the depth of cut in milling, drilling, etc. The spindle is hollow and it is furnished with draw-bolts for holding milling cutters, split collets, etc. Drilling, milling, boring and slotting operations can be performed at any angle and at a single setting of the work.

Reversal of the direction of spindle rotation can be accomplished, and the drive can be disconnected to allow the spindle to be revolved freely by hand. A locking pin provides means of securing the spindle while changing cutters, etc. The clutch pulley has an oil reservoir insuring thorough lubrication for long periods, and a cone brake opposes the clutch and is engaged when the clutch is disengaged, thus bringing the machine to an instant stop. Changes of speed are instantly obtainable by shifting a lever that is located within easy reach of the operator when in his working position. The plain milling machine is provided with ten spindle speeds and twelve feed changes, and it will take any of the standard attachments furnished for the universal machines.

### Arrangement of the Shaper Ram

The shaper ram is adjustable for a stroke from 0 to 6 inches, and the tool-head is adjustable on the ram through a full circle. A toggle link and adjustable dogs afford positive operation for the clapper-box. The crank-arm is made of solid steel, and compensation is provided in the crankpin

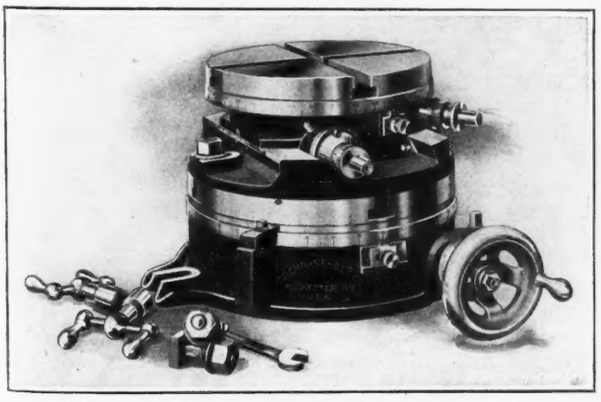


Fig. 3. Circular and Compound Tables used in Combination on the Cochrane-Bly Machines

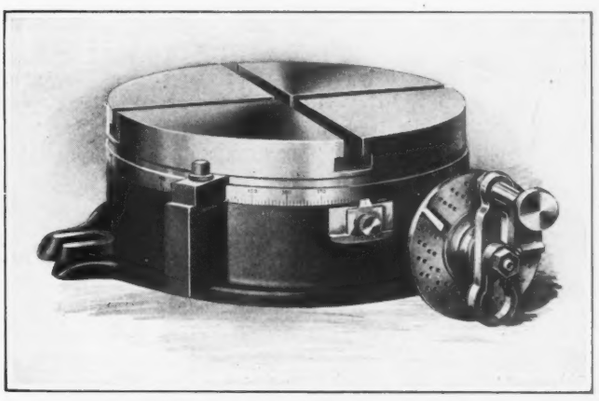


Fig. 4. Circular Table with Dividing Attachment for Use on Cochrane-Bly Machines

box to take up wear on both the crankpin and link. A friction clutch pulley and a double cone of gears running in oil transmit the driving power. All gears in the machine are made of steel and the gears in the driving train are hardened.

Attachments for Use on the Machine

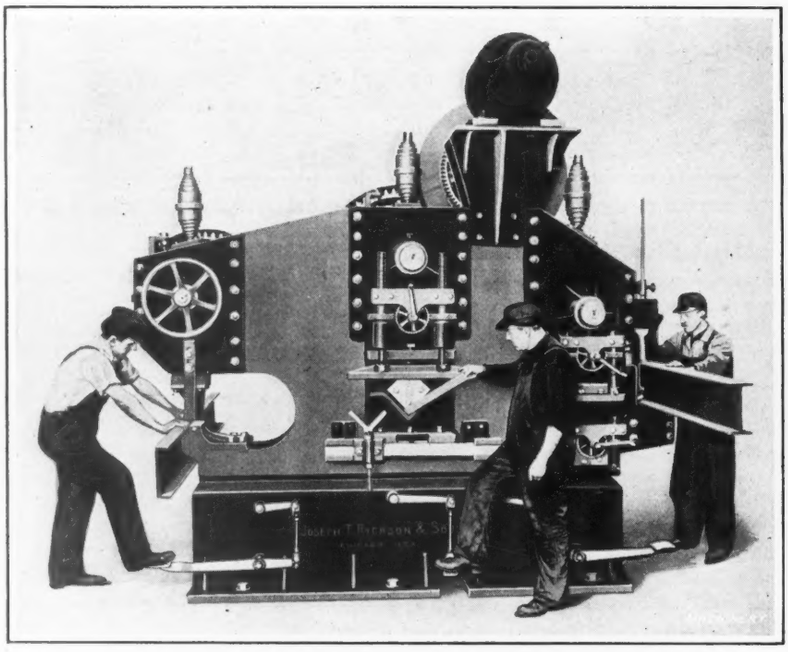
An important part of the equipment furnished with these machines consists of a circular table provided with a dividing attachment, and the compound circular table. With these attachments holes can be drilled and bored in jigs on five sides of a block, without requiring the work to be reset. Radial slots can be accurately spaced and planed at any angle. Keyways may be spaced at any number of degrees and minutes apart, and they may be cut in either straight or tapered holes. Die-blocks may be readily drilled, bored, shaped and filed, without requiring the work to be reset. By using the circular and compound tables in combination, dies and other parts can be machined from any number of centers, and circular arcs with different centers may be brought together. Intricate forms and shapes may be developed with a high degree of accuracy. Examples of work on which such operations are required are tools and templets for tire molds, molds for bakelite products, dies for die-casting metal, molds for glassware, etc., dies for blanking and forming sheet metal, metal pattern work, and many similar operations.

Provision is made for using the standard Brown & Sharpe vernier scale outfit on both the longitudinal and transverse slides, thus assuring the attainment of accurate measurements. In addition to the circular and compound tables, a plain milling machine vise, drill chuck, spring chuck, collets, sleeves for Morse and B. & S. tapers, draw-bolts, centers, and expanding arbors can be furnished as special equipments. A simple form of individual electric motor drive can be applied to all of these machines.

Principal dimensions of these machines are as follows: Size of table inside oil-pockets, 9 by 29 inches; longitudinal table travel, 18½ inches; transverse table travel, 9 inches; vertical table travel, 18 inches; size of T-slots, ⅝ inch; adjustment of center head, 360 degrees; forward and back adjustment of milling head, 40 degrees; forward and back adjustment of shaper head, 40 degrees; range of milling spindle speeds, 55 to 330 R. P. M.; maximum speed of high-speed milling attachment, 1400 R. P. M.; maximum distance from table to spindle, 20 inches; maximum distance from table to tool-head, 18 inches; distance from center of spindle to column, 13 inches; range of shaper speeds, 25 to 150 strokes per minute; taper of hole in spindle, No. 9 B. & S.; diameter of hole through spindle, 17/32 inch; rates of feed per revolution of milling spindle, 0.002, 0.004, 0.006, 0.008, 0.016 and 0.024 inch; feeds per stroke of shaper ram, 0.0025 to 0.020 inch; speed of driving pulley, 500 R. P. M.; size of driving pulley, 10 inches in diameter by 3 inches face width; and floor space occupied by machine, 57 by 66 inches.

## RYERSON QUINTUPLE PUNCH AND SHEAR

The quintuple combination punching and shearing machine which is shown in an illustration that accompanies the following description, is a recent product of Joseph T. Ryerson & Son, 16th and Rockwell Sts., Chicago, Ill. This machine is built with a steel frame which affords ample strength for the heavy service required of it, without making the weight or bulk unnecessarily great. The machine is shown with three of the five available units in operation. The combination of five units in a single machine is the means of saving a lot of floor space; and where several operations are to be performed on the same piece of work, time is also saved which would otherwise be required to transport heavy pieces from one machine to another. No changing of attachments or tools is necessary to enable this machine to perform such operations as shearing plates or round and square bars, coping and notching, section cutting and punching. Another advantage claimed for this machine is that it makes clean, accurate cuts without having any tendency to distort the shape of the work.



Quintuple Punching and Shearing Machine built by Joseph T. Ryerson & Son

At the operating side of the machine there are no overhanging members; all parts of the driving mechanism such as gears, clutches, and flywheels being located at the opposite side. This constitutes an important safety feature. The different units of the machine are also located far enough from each other so that one or more operators will not interfere, if it is desired to use several parts of the machine simultaneously. The section cutter is given ample space to allow the operator to cut material right- or left-hand as desired. All foot-lever connections for operating the clutches are arranged so that they do not interfere with long plates when passing through the full length of the machine frame for slitting operations. Three-jaw automatic clutches are used, which are independent of each other. The clutch on the punch end is provided with a loose disk to permit adjustment of stroke at any desired position. The clutch for the slitting shear, bar cutter, and coping and notching mechanism can be operated by either a hand-lever or foot-treadle. The clutches for the punch and the section cutter are controlled only by means of treadles.

All gears and pinions of the machine are made of cast steel with teeth cut from the solid metal, with the exception of the motor gear on machines operated by direct-connected motor drive. The clutch gears and eccentric shafts run in bronze bushings provided with means for ample lubrication. Heavily constructed outboard bearing brackets take up all strain. When the machine is to be equipped with a direct-connected driving motor, the motor bracket and a gear and rawhide pinion are furnished for mounting the motor at the top of the machine. Where belt drive is to be employed, a tight and loose pulley and a belt shifter are furnished with the machine.

## FLATHER MANUFACTURING LATHE

*This machine swings approximately 8 inches over the ways and it will hold pieces of work up to 15 inches in length between centers. It is adapted for a wide range of manufacturing and tool-room operations that are ordinarily done on a machine of larger size, which is more expensive and occupies a greater amount of floor space.*

A 7-inch ball bearing manufacturing lathe has recently been developed by the Flather Mfg. Co., Nashua, N. H., which is adapted for use on both tool-room and production work that comes within its range. This is a high-speed, screw-cutting engine lathe of sufficient capacity to handle a great many jobs that are ordinarily set up on much larger machines. Each unit of the new Flather lathe has been carefully designed with a view to providing convenient

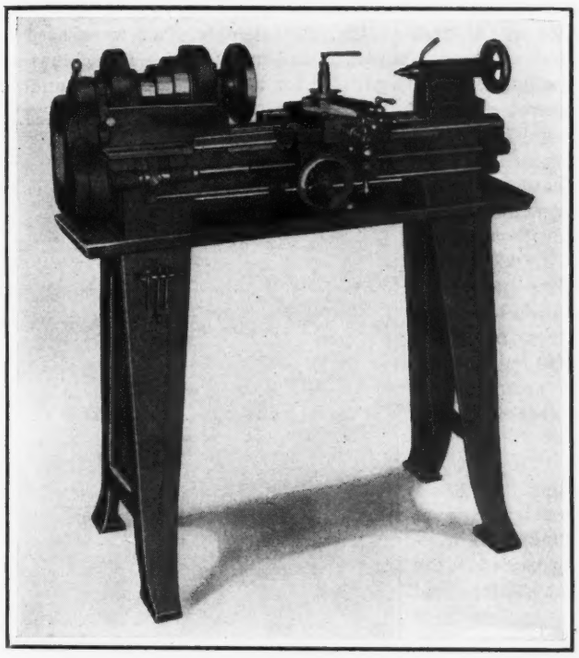


Fig. 1. Floor Type of 7-inch Ball Bearing Manufacturing Lathe built by the Flather Mfg. Co.

means of operation, in addition to adequate strength and durability. Although it is rated as a 7-inch machine, the actual swing over the ways is approximately 8 inches, and the lathe will hold work up to 15 inches in length between centers. The bed is 36 inches long and it is braced with cross-ribs. On bench type machines the bed is cast integral with the legs while on floor type machines the bed is bolted to the pan and legs. A taper attachment is furnished, which is interchangeable on any of these machines, so that a taper attachment may be ordered at a later date for use on any machine that is already in service.

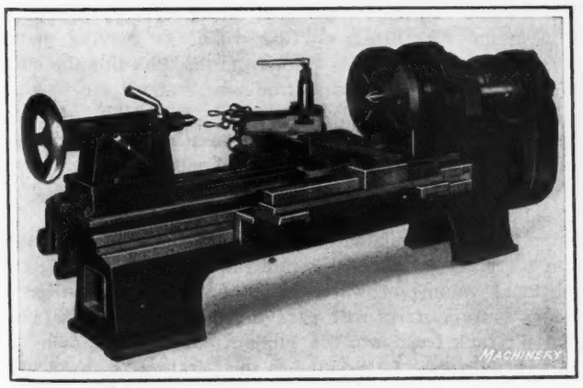


Fig. 2. Rear View of Bench Type of Flather Manufacturing Lathe, showing Arrangement of Taper Attachment

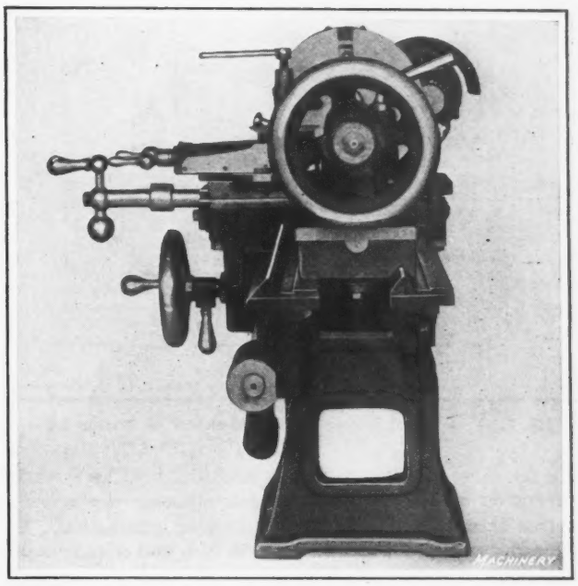


Fig. 3. Right-hand End of Flather Lathe showing Design of Bed

Long bearings are provided for the headstock on the bed. The spindle is made of high-carbon steel with a ¾-inch hole bored through it. Draw-in chucks with collets up to ½ inch can be used in this spindle. A No. 3 Morse taper socket is reamed at the front end of the spindle, and the spindle bearings are fitted with liberally proportioned bronze boxes. The 3-step cone pulley carries a 1¼-inch belt and this pulley is mounted on heavy ball bearings that are held in separate housings from those carrying the spindle bearing boxes. These ball bearings take the strain and pull of the belt, and

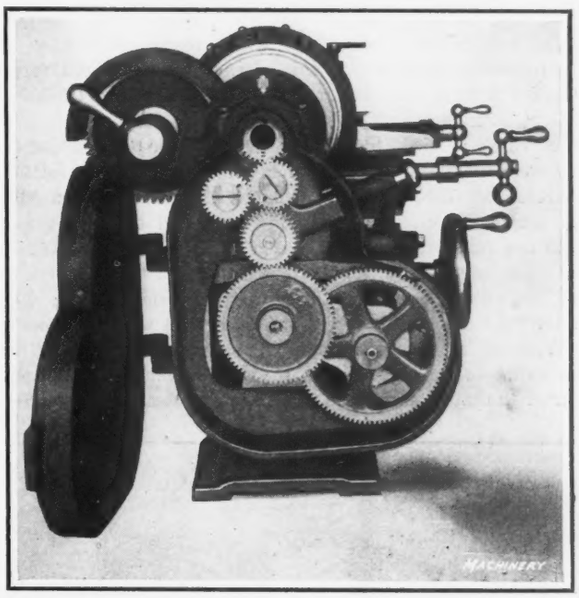


Fig. 4. Left-hand End of Flather Lathe showing Arrangement of Gearing

allow the spindle to run freely, thus affording the maximum power and making it possible to employ spindle speeds as high as 1500 or 2000 revolutions per minute. The machine is back-geared in the ratio of 7 to 1.

Long bearings are provided for the carriage on the bed and they are furnished with felt wipers to remove foreign matter from the ways and to facilitate lubrication. A feed-stop is provided, which can be instantly set for any length of feed that is required. This stop automatically disengages the feed clutch. The lead-screw is 13/16 inch in diameter with ten Acme threads per inch. Great care is taken in cut-

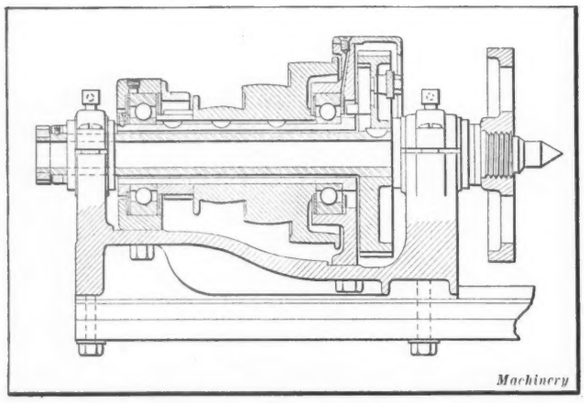
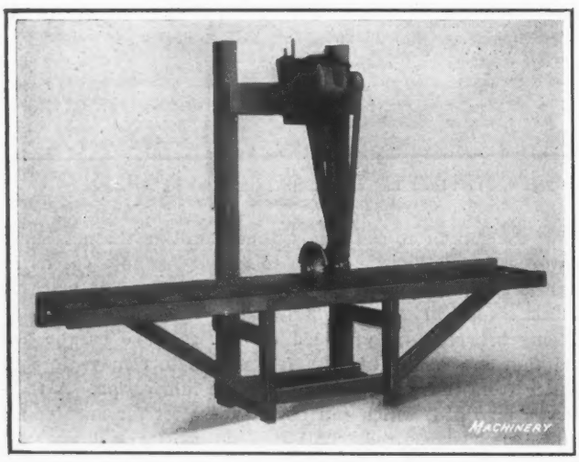



Fig. 5. Longitudinal Section through Headstock of Flather Lathe showing Ball Bearings that support Cone Pulley

ting the thread on the lead-screw and it is held by a central bearing on which the step nuts act, allowing the screw to be free at the back end for expansion or contraction. The lead-screw nut is cut from solid cast iron and it is operated by a cam. A travel of 4½ inches is provided for the cross-slide, and the compound rest has a travel of over 1½ inch. Attention is called to the fact that the cross-feed nut does not have to be disconnected when using the taper attachment. A double friction type of two-speed countershaft is used to drive this machine. Positive adjustment of the friction is provided, and care has been taken to have the rotating members carefully balanced in order that they may run without vibration at high speed. The bench type of machine weighs approximately 300 pounds and the floor type machine weighs about 400 pounds. The floor space occupied is 24 by 42 inches.

## RENO-KAETKER SWING SAW

The motor-driven swing saw which forms the subject of the following description, is a recent product of the Reno-Kaetker Electric Co., 701 Gerke Bldg., Cincinnati, Ohio. It will be seen that this machine has a base for the swinging arm, which is so designed that the base can be mounted on any convenient wall or column in an out-of-the-way position, because with the electric motor drive, a lineshaft is not needed to furnish power. The swinging arm and the two motor rails are fastened to a bar which is movably connected to the base; and a keyway holds the rails from turning around the bar, although they can be moved from side to side. The motor rails are keyed at such an angle that when the motor is mounted in place, its weight acts as a counterbalance for the swinging arm and causes the arm to move back to the rear of the table as soon as the operator releases the handle.

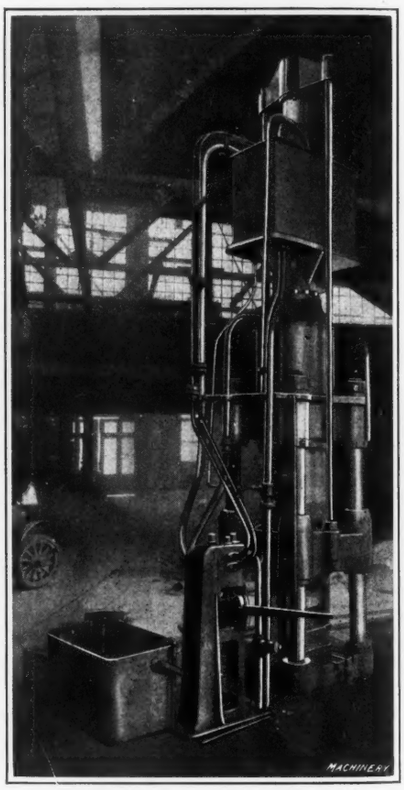



Motor-driven Swing Saw built by the Reno-Kaetker Electric Co.

Upon reaching its rear position, a catch mechanism retains the arm at the back of the table, this catch being so arranged that the arm cannot be pulled forward without gripping the handle. As a result, there is no danger of the arm swinging like a pendulum and injuring the operator or persons who are passing near the machine. Another feature of this equipment is the design of the arm. It will be noted that the lower end is bent backward so that, as the arm moves forward, it will strike the operator before the saw can injure him. With such an arrangement, there is very little danger of a workman being cut. Another feature of this design is that it locates the belt out of the operator's way.

## SOUTHWARK FORGING PRESS

Hydraulic shell-piercing presses built by the Southwark Foundry & Machine Co., Philadelphia, Pa., were used in numerous munition plants, and many of these machines are now lying idle. To provide for adapting them for handling general classes of forge work, this company has designed a single-lever high-speed valve control and a low-pressure filling tank. This tank is located at the top of the main cylinder to which is attached a special casting that forms the bottom of the filling tank. A large low-pressure filling check valve is provided in the tank bottom and the pull-back is inside the tank, in order to reduce the over-all height of the press. A single lever operates the main cylinder, the pull-back cylinder, and the low-pressure filling check valve. By moving this operating lever from its neutral position slightly downward, the pressure water from the pull-back cylinder is exhausted, and the low-pressure filling valve operating the main cylinder is lifted, so that when the moving platen descends, the low-pressure water from the tank fills the main cylinder until the die comes into contact with the forging. At this point, the valve lever is moved still further, allowing the high-pressure water to enter the main cylinder, thus doing the actual forging with the full capacity of the press. Then, by raising the valve lever, the filling check valve is opened and pressure is applied to the pull-back which will return the moving platen of the press, exhausting the water from the main cylinder back into the filling tank, while the additional volume of water which has been used from a high-pressure cistern will pass through the overflow pipe from the tank back into the suction pump of the tank.



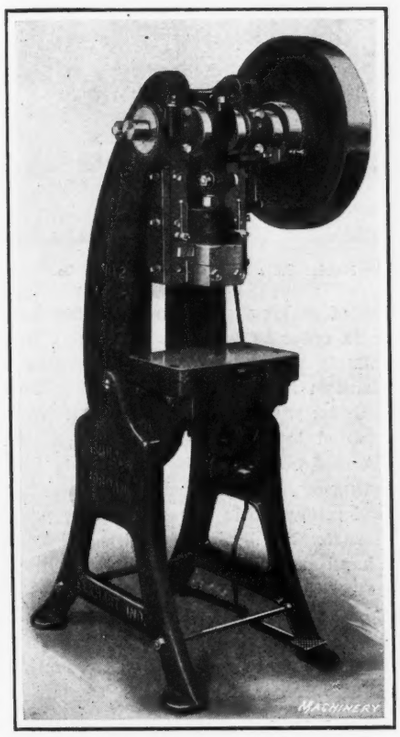

Shell-piercing Press built by the Southwark Foundry & Machine Co., which has been adapted for the Performance of General Forging Operations

A 350-ton press of this kind is in operation in the Southwark Foundry & Machine Co.'s forge shop, which is said to be giving satisfactory results on general work. This press

is able to make from twenty-five to thirty full-capacity working strokes per minute, and from fifty to sixty light working strokes per minute. This type of press will require a comparatively small sized accumulator, while the pump capacity will be equal to the quantity of water used for the short high-pressure stroke for a specified number of strokes per minute.

## LOSHBOUGH-JORDAN INCLINABLE POWER PRESSES

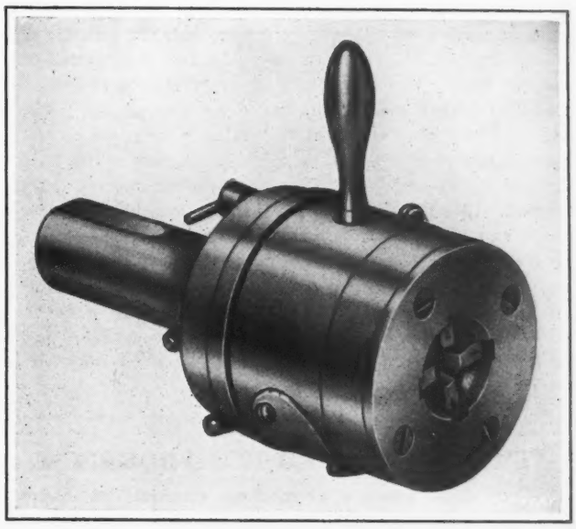
The Loshbough-Jordan Tool & Machine Co., Renn St. and Sterling Ave., Elkhart, Ind., has recently added Nos. 1 and 2 plain open-back inclinable power presses to its line. In designing these machines, an effort has been made to combine the features of simplicity, strength, and durability with the necessary convenience of operation. It will be seen that the machines are of the open-back inclinable type and they can be easily changed from one position to another. All parts of the mechanism are accessible, so that adjustments may be made without loss of time, and all working parts are adjustable enabling compensation to be made for lost motion developed through wear resulting from continuous service. Making such adjustments enables the press to be kept accurate during its entire operating life. Wrenches for making adjustments are a part of the regular equipment of this machine. The No. 1 press has a capacity for pressures up to 10 tons, and the No. 2 press develops 14 tons pressure.



Loshbough-Jordan Inclinable Power Press built in Nos. 1 and 2 Sizes

## VICTOR SELF-OPENING DIE-HEAD

The Victor Tool Co., Waynesboro, Pa., is now manufacturing a self-opening die-head which is illustrated and described herewith. Descriptions have been published in MACHINERY of the collapsible taps made by this company and in introducing the new self-opening die-head, the manufacturer states that the same general principles of design and construction have been applied; in other words, the die-head is a collapsible tap "turned inside out." The chasers are supported by individual plungers having a 14½-degree angle, to which the chasers having a corresponding angle are held by means of a slot that fits over a tongue on the plunger. Each plunger is securely held in a scroll ring or collar, which guarantees positive and absolutely simultaneous action in opening or closing the die-head. This construction also provides a bearing at the back of the chasers for their entire length. Without sufficient support, the chasers are apt to tilt and cut tapered threads. When the travel of the turret is stopped, the Victor die-head opens automatically. The die-head can be opened at any point by simply retarding the travel of the turret-slide by means of a handle or by disengaging a pin in the latch attachment of the die-head. A hollow shank can be furnished for the die-head to provide capacity for cutting any desired length of thread, and special shanks can be furnished to fit any machine on which the die-head is to be used. Adjustment is provided up to approximately 1/32 inch, either over size or under size, making it possible to cut a tight or a loose fitting thread, as desired. Adjustment is obtained by means of two knurled thumbscrews at the back of the head, one of these screws being used for adjusting, while the other acts as a lock-screw. The head is accurately graduated to determine the proper adjustment.

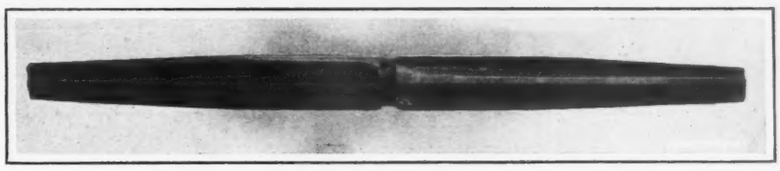


Self-opening Die-head made by the Victor Tool Co.

Each head is regularly furnished with a roughing and a finishing attachment, operated by a small lever at the base of the head, which sets the chasers back approximately 0.010 inch for taking the roughing cut; and then by returning the handle to its original position, the chasers are set for the exact finished diameter to which the head has been adjusted. This arrangement is especially useful when cutting coarse threads or exceptionally tough stock. Right- or left-hand threads of standard or special pitches may be cut in any form of thread. Standard die-heads of this type will cut to within 1/8 inch of a shoulder, and where the shoulder is too large to fit into the opening of the die-head, the chasers can be extended through the cap to permit them to reach closer to the shoulder. The chasers may be easily changed in one of these die-heads by removing the cap and lifting the chasers out of the plungers, slipping others into place, and then replacing the cap. The die-head is entirely enclosed so that there is no possibility of chips, dirt, or other foreign matter finding its way into the mechanism.

## CAIRD DOUBLE-END BRIDGE REAMER

In the accompanying illustration, there is shown a reversible double-end bridge reamer which is made by R. A. Caird, 1226 Oliver Bldg., Pittsburg, Pa. A special chuck is furnished for holding these reamers, which is equipped with jaws to hold the fluted end so that the reamer may be reversed after one end becomes dull. Each jaw of the chuck



Reversible Double-end Bridge Reamer made by R. A. Caird

carries a pilot which fits into one flute, these pilots being offset in such a way that they do not dull the cutting edges of the reamer. The claim is made for this principle of reamer design that on a tool of average size at least one pound of high-speed steel is saved by not having a shank; and one of these tools can be sold for from 30 to 50 per cent less than two high-speed steel reamers with shanks. On field work, an additional saving is often effected through the possibility of reversing a Caird reamer and using the opposite end, instead of having to wait for a tool which has been accidentally damaged. The flutes in the two ends of the reamer are staggered in such a way that the maximum strength is obtained. The chucks furnished with these reamers are equipped with two sizes of jaws to take six different sizes of bridge reamers. These tools are adapted for use in bridge work, structural steel plants, boiler shops, etc.

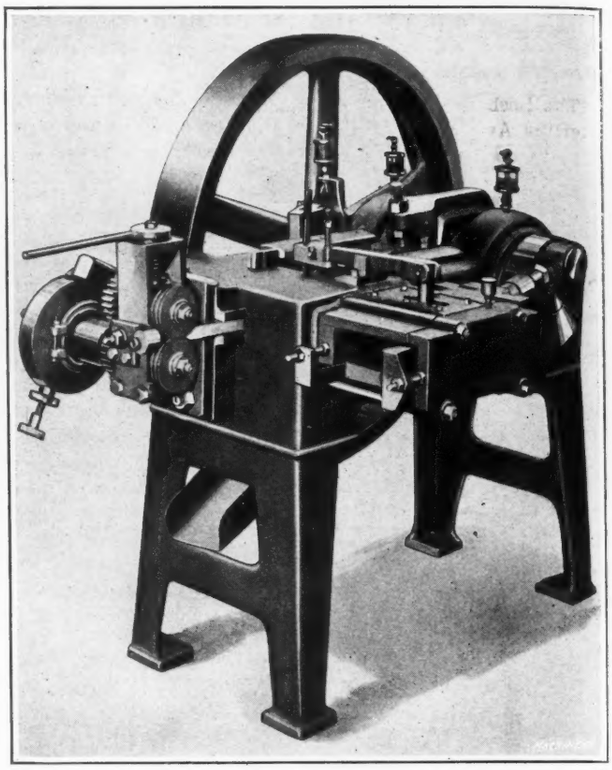
## "THOR" IMPROVED HOSE COUPLING

An improved type of "Thor" hose coupling has recently been added to the line of pneumatic tools and auxiliary equipments manufactured by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. This coupling is of the sliding sleeve type. There is a locking collar on each end, and when the coupling is connected, these locking collars or sliding sleeves work in opposite directions and cannot be disengaged by coming into contact with rough surfaces. This makes a positive locking arrangement under any conditions. When desired, the coupling can be instantly disconnected by a straight pull on the sliding sleeve at each end, and it is not necessary to twist the sleeves as the beveled jaws separate as soon as the locking shoulder moves back. The sliding sleeves are said to be amply proportioned to resist any ordinary strains to which they are likely to be subjected, and the operating spring may be easily replaced, if necessary, by simply removing a washer at the back end. An L-shaped gasket is used, and when the coupling is connected, this gasket is held in place by air pressure. It cannot be blown out when the coupling is disconnected, because it is held by a projecting shoulder.

## KENT SINGLE-STROKE HEADER

The Kent Machine Co., Kent, Ohio, is now building a solid-die, single-stroke header of ¼ inch capacity. A Scotch yoke with a solid wedge adjustment is used on this machine instead of a connecting-rod. The use of this type of mechanism for driving the cross-head forward affords an action of unusual uniformity and freedom from vibration. The flywheel has a tapered square hole in it, which fits over the end of a shaft that is formed like the frustum of a pyramid. This is a desirable method of construction when it is found necessary to disassemble the machine; also, it affords a positive drive up to the full pulling power of the belt.

Particular attention has been paid to designing the cut-off mechanism. All parts are liberally proportioned and provided with means of adjustment for wear. The designers

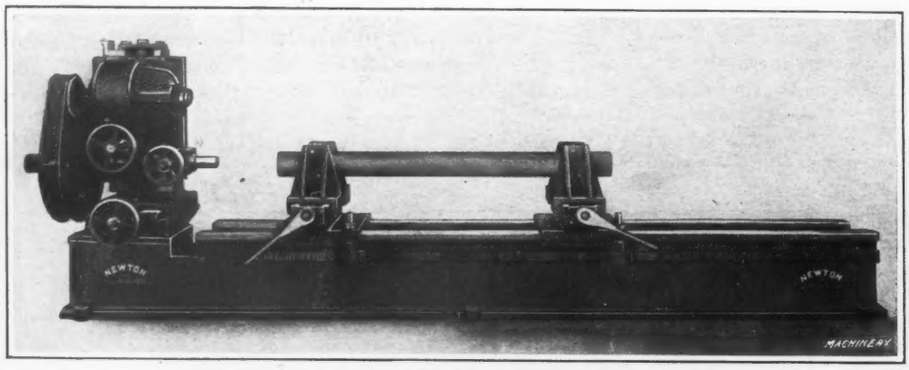


Single-stroke Solid-die Header built by the Kent Machine Co.

have also made a point of making all parts of the mechanism readily accessible, in order to facilitate making repairs or adjustments. By simply removing four nuts practically the entire cut-off mechanism is opened up. A friction feed is provided on the machine, which consists of two grooved feed-rolls that are actuated by a combination ratchet and ball friction device. A feed-stop finger is provided to look after any over-feed setting of the feed mechanism, although the accuracy of the feed relieves this finger from any great amount of work or pressure. The length of feed is regulated and controlled by the hand and check knobs, shown projecting from the lower part of the feed disk; and the feed may be instantly disengaged by an eighth turn of a lever located on top of the feed-roll support. This machine is the first of a line of rivet making machinery to be placed on the market by this company.

## NEWTON CENTERING MACHINE

The Newton Machine Tool Works, Inc., 23rd and Vine Sts., Philadelphia, Pa., are now building a machine for use in centering rough and irregular shaped forgings. Two universal centering vises of the interlocking type are furnished with this machine, the jaws of these vises being adjusted by means of screws to afford sufficient capacity for holding round work from 2 inches to 12 inches in diameter. Provision is made for moving the vises along the bed of the machine by means of a rack secured to the bed and a pinion carried by each vise. The machine spindle is made of forged steel; it is 3 inches in diameter and runs in bronze-bushed bearings. A cross adjustment of 4 inches and a vertical adjustment of 4 inches are provided for the spindle, and also a hand feed of 8 inches. The cross and vertical adjustments are equally divided




Centering Machine built by the Newton Machine Tool Works, Inc.

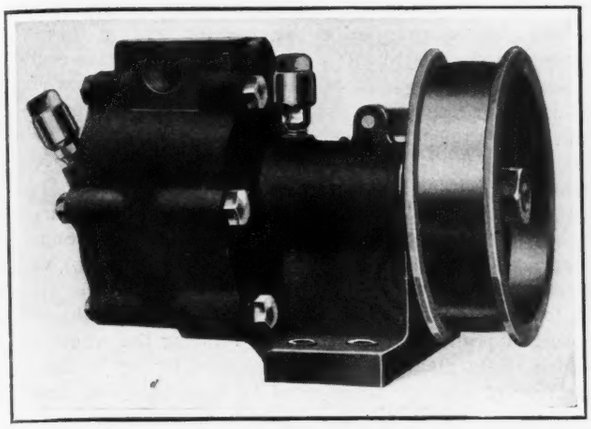


Fig. 1. "Rollway" Lubricant Pump manufactured by the Michigan Machine Co., Detroit, Mich.

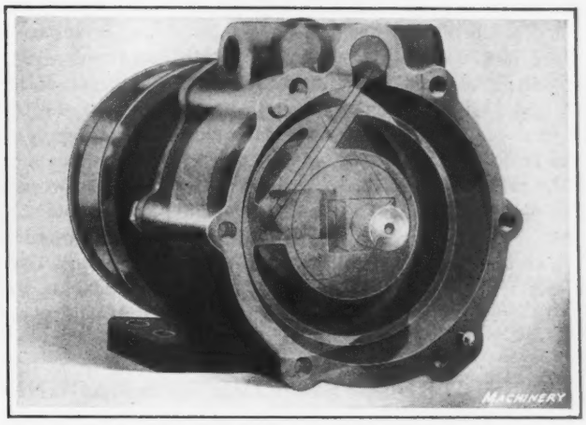


Fig. 2. Phantom View of "Rollway" Lubricant Pump showing Arrangement of the Mechanism

from the center line of the work. Accurate alignment of all moving parts of the machine is maintained by adjustable tapered shoes. It will be seen that the machine is driven by a direct-connected motor.

The principal dimensions of this centering machine are as follows: Diameter of spindle, 3 inches; in-and-out adjustment of spindle, 8 inches; vertical adjustment of spindle, 4 inches; cross adjustment of spindle, 4 inches; length of machine bed, 16 feet; width of base, 22 inches; maximum distance from center of spindle to top of bed, 17½ inches; minimum distance from center of spindle to top of bed, 13½ inches; and distance from center of vise to top of bed, 15½ inches.

## "ROLLWAY" LUBRICANT PUMP

The "Rollway" pump which has recently been placed on the market by the Michigan Machine Co., of Detroit, Mich., is adapted for delivering coolant to cutting tools and for providing forced feed lubrication for bearings. Its principal working parts consist of two rollers which rotate eccentrically in the pump chamber, and as the entire operating motion is one of rolling, it is claimed that wear is reduced to a minimum. This pump is self-priming and it may be used anywhere within 10 feet above the level of the liquid to be pumped. In this position it will prime itself. If all the fluid is pumped out of the tank so that the pump is sucking air, it will start pumping again when the tank is refilled, without requiring priming. No relief valves or overflow piping are required. The outlet in the discharge pipe may be closed and the pump allowed to run without damage to any part of its mechanism. This result is obtained by using a spring placed in the rectangular slot in the inner roller, which bears against a squared shaft. This spring operates only when the pressure on the pump is as great as the pressure required to compress the spring. When this pressure is reached, the compression of the spring allows the rollers to come to the center of the pump chamber, where they continue to revolve in the liquid without developing further pressure.

It is claimed that the "Rollway" pump's action is not affected by the presence of foreign matter in the liquid and that it will not become clogged. Should it happen that metal chips, paper, rag, waste, etc., which can pass through the intake pipe, find their way into the pump, they will pass through without clogging, because the action of the pump consists of rolling the liquid in front of the pump rotor. Should it happen that a chip sticks while passing through the pump, the spring to which reference has just been made, will be compressed and allow the roller to pass over the obstacle without damaging the pump in any way. After the chip has been released by this means, the liquid will wash it out of the pump at the next revolution of the rotor. Another feature of this pump is that it may be used upside down or in any other position, just as well as right side up. This enables the pump to be mounted in any position on the machine that is most convenient.

Either side of the pump can be used as an intake or outlet. The pump may also be reversed without damage and it will deliver liquid again immediately after starting rotation in the proper direction. This adapts the "Rollway" pump for use on reversing machines, where the pump is not required to deliver during the period of reversal. Where it is necessary to maintain a constant flow in a given direction, regardless of the direction of pulley rotation, the pump may be equipped with reverse valves. The speed of rotation is not a factor in determining the efficient operation of this pump. It may be operated at speeds ranging from 100 to 600 revolutions per minute or higher, making the pump applicable for use on all types of machine tools, without additional expense for either a high- or a low-speed drive. At present these pumps are being made with ½- and ¾-inch intake and outlet openings, but they will later be made in sizes ranging from ¼ inch to 2 inches for the diameters of the intake and outlet.

## WINDAU MULTIPLE LATHE TOOL-HOLDER

The Windau Tool Co., 1565 E. 17th St., Cleveland, Ohio, is now making a "4-in-1" type of turret tool-holder for use on lathes. As is clearly shown in the illustrations, this holder is provided with a turret in which four different tool bits may be mounted so that, by revolving the turret, either of

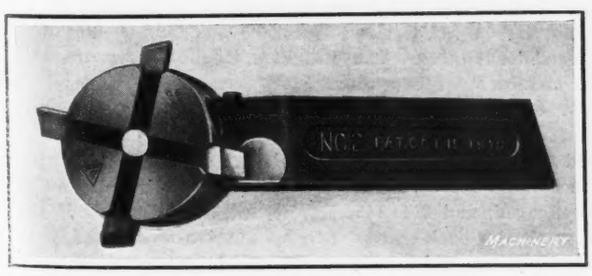


Fig. 1. Multiple Lathe Tool-holder made by the Windau Tool Co.

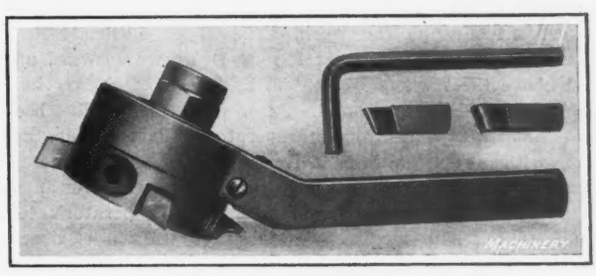
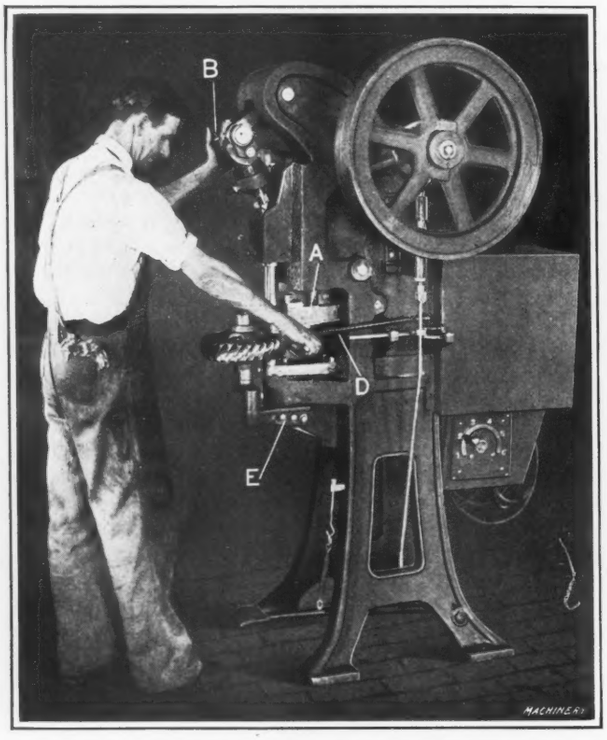


Fig. 2. Side View of Multiple Lathe Tool-holder

these bits may be readily brought into the operating position. Ratchet teeth are cut inside the turret to engage a spring pawl carried by the shank of the tool-holder, thus providing means of assisting to support the thrust of the cut, and also locating the turret in position to give the tool bit that is in the operating position, the proper degree of rake and clearance. Each of the tool bits is held in place in the turret by a headless set-screw operated by the wrench that is shown in Fig. 2, and this method of clamping affords at least ¼ inch adjustment to compensate for reduction in the length of the tool bits due to grinding. Tools of this type are made with shanks 1¼ by ⅝ inch in size and they carry ⅜-inch square high-speed tool steel bits.

## WINFIELD ELECTRIC RIVETING MACHINE

In order to explain clearly the work done by a new electric riveting machine recently placed on the market by the Winfield Electric Welding Machine Co., Warren, Ohio, attention is first directed to the worm-wheel which is shown supported by a bracket at the front of the machine. This piece consists of a bronze rim in which the teeth are generated, and two cast-iron flanges which fit into counterbored recesses on each side of the bronze rim, to form the body and hub of the wheel. The flanges are secured by ten rivets that are headed on the machine which is here illustrated and described.

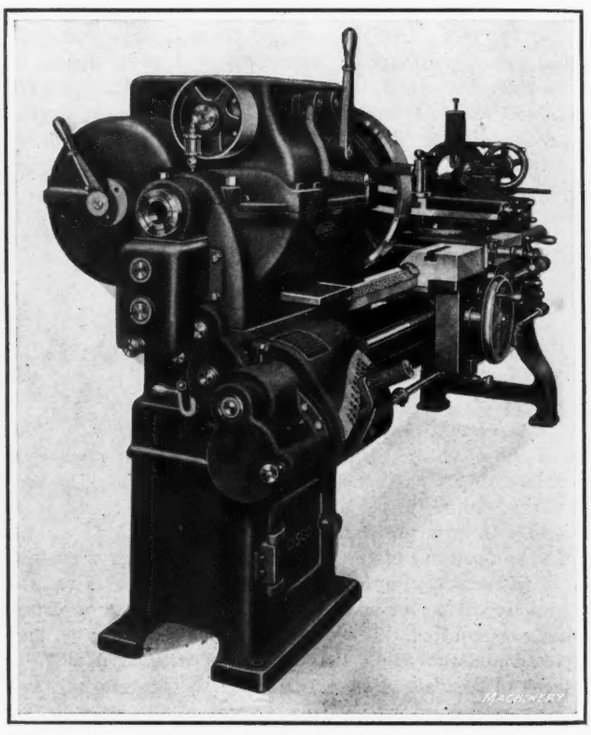



Riveter built by the Winfield Electric Welding Machine Co.

This apparatus is provided with an "open coil" transformer for properly transforming the line voltage for the particular class of work for which it was designed, and a Cutler-Hammer remote control switch for governing the flow of current through the work. The upper electrode *A* is mounted in such a way that it may be drawn forward and just above the rivet to be heated, by means of a lever held in the operator's right hand. After the electrode has been brought into this position, the operator pulls down another lever with his left hand, to bring the electrode *A* into actual contact with the rivet and complete the electric circuit. A push-button at the end of the lever in the operator's left hand is then depressed, a small auxiliary switch is closed, and the Cutler-Hammer remote switch is brought into play, allowing the current to flow through the work and heat the rivet in a very short space of time. After the proper temperature has been secured in the rivet for heading, the lever in the operator's left hand is raised which brings the contact *A* clear of the rivet. After releasing the lever in his right hand, spring *B* pulls electrode *A* back, so as not to interfere with the movement of the steel heading tool which is directly above the rivet at all times. Depressing a foot-treadle brings the heading tool down by power on the rivet, quickly heading it. A controller may be set to adjust the current for any size of rivet to be headed. From 2000 to 2500 amperes of current are delivered to the electrode at 2.5 to 5.5 volts. It will be noted that the worm-wheel in which the rivets are to be set is carried on a bracket which locates the work in such a position that, by simply rotating the wheel, successive rivets may be brought into position to be headed. Machines of this type are adapted for heading rivets ranging from ¼ up to and including ⅝ inch in diameter.

## CISCO GEARED-HEAD LATHE

The Cisco Machine Tool Co., Cincinnati, Ohio, has recently added to its line, geared-head lathes which may be equipped for either belt or individual motor drive. Only four levers are required to obtain a range of ten speeds; and twenty changes of speed are available where the machine is driven by a double friction countershaft, while ten changes are obtained with individual motor drive. All gears are of steel with the exception of two rawhide gears. The same head base is used on all Cisco lathes, whether they are of the belt-driven, motor-driven, geared-head, or motor-driven geared-head type; and the same head top is used on the motor-driven, belt-driven geared-head, and motor-driven geared-head lathes. The design is simple and compact and no members are overhung.



Cisco Geared-head Lathe with Belt or Individual Motor Drive

Where belt drive is employed, a double friction countershaft is used, which has one pulley running at 300 R. P. M. and the other at 130 R. P. M. The high-speed pulley furnishes ten spindle speeds, namely, 300 and 200 with the back-gears disengaged, and 214, 146, 116, 78, 54, 36, 29, and 19 R. P. M. through the back-gears. The low-speed countershaft pulley furnishes ten additional spindle speeds, namely, 130 and 88 R. P. M. with the back-gears disengaged, and 93, 63, 50, 34,

23, 15, 12, and 8.5 R. P. M. through the back-gears. This liberal range of spindle speeds is obtained by four levers (including the back-gear lever). One handle controls a powerful friction on the spindle and two handles control the shifting of four back-gears on the eccentric shaft. A pull-pin in the face-gear is used to run straight from the spindle when the back-gears are out of mesh. The eccentric shaft lever or back-gear lever engages the back-gears with the spindle gears. On the spindle there is a friction and six gears; and there are four gears on the back-shaft and two gears on the driving shaft. All gears and spindles are made of 40- to 45-point carbon steel except the driving gears which are made of rawhide.

Where motor drive is employed, a plate is placed on top of the regular geared head, with a bracket on this plate for supporting an intermediate stud that carries the intermediate rawhide gear. A pinion is placed on the motor spindle and a gear on the driving shaft, both the pinion and gear being made of steel. The gears are covered, and the spindle speeds obtainable with this arrangement of motor drive are 220 and 150 R. P. M. with the back-gears disengaged, and 158, 107, 86, 58, 40, 27, 21, and 14 R. P. M. through the back-gears. A direct-current Westinghouse motor running at 1800 R. P. M., or a direct-current General Electric motor running at 1700 R. P. M. may be used to drive the machine. A 2½-horsepower motor is required for a 14-inch lathe, 3 horsepower for a 16-inch, 5 horsepower for an 18-inch, and 7½ horsepower for a 24-inch machine.

## LUMSDEN OSCILLATING TOOL GRINDER

Unless the forging of high-speed steel tools is done by a thoroughly experienced workman, it is probably safe to say that the quality of the steel is not improved by the forging operation. It is upon this premise that the Lumsden oscillating tool grinder has been developed, the purpose of which is to provide a means of grinding lathe, planer, shaper and slotter tools direct from steel sections up to 1 by 1½ inch in size. At least 75 per cent of the tools used in the average machine shop are made from sections of this size or smaller; but where tools must be made from larger sized bars, they should be roughly forged to shape before finishing them on the tool grinder, because there is so much excess metal to be removed that it cannot be done economically with a grinding wheel. Practically all tools that can be made from straight pieces of bar stock up to ⅞ by 1¼ inch in size can be shaped by dry grinding on the Lumsden grinder at the rate of twenty per hour, and larger sections up to 1 by 1½ inch in size can be shaped at the rate of twelve per hour.

Lumsden oscillating tool grinders have recently been introduced by Alfred Herbert, Ltd., 54 Dey St., New York City. In working out the design of this grinder, provision has been made for holding the tool stationary and oscillating the wheel across the tool by power. This oscillatory movement is accomplished by having the wheel-head mounted on an inverted pendulum which is oscillated by power transmitted through a patented eccentric mechanism. This device is so arranged that it can be adjusted by manipulating lever *A* to vary the distance through which the wheel oscillates from 0 to 1¼ inch or 0 to 1½ inch, according to the size of the machine. The wheel-head is of cylindrical form and it is so mounted on the oscillating base, that by turning a handwheel *B* provision is made for advancing the wheel toward the tool or withdrawing it, as required. Handwheel *C* provides the third adjustment, namely, that of positioning the wheel so that it oscillates back and forth in the desired position for the tool that is being ground. It will be apparent that the entire control is centralized, so that all wheels and levers are within easy reach of the operating position. The machine is started and stopped by means of a foot-treadle directly below the operating position.

On the Nos. 1 and 2 machines the tool-holder is universally adjustable for all forms of tools other than those which are "cranked" or offset to a right angle. A fixture for holding such tools, and also one for holding tools while they are being ground on the base, are the only loose parts of the machine. Any shape or form of tool can be quickly ground without the use of a former, templet or fixture, barring the ones which have just been mentioned and tools which have a curved top face. Such tools are shaped by a patented curved-face attachment. The tool-holder is a very simple device which grips all rectangular and square tools by the two top corners and the base. It can rotate on its own axis, swivel on trunnions several degrees on either side of the horizontal, and swing on a turntable on a vertical axis.

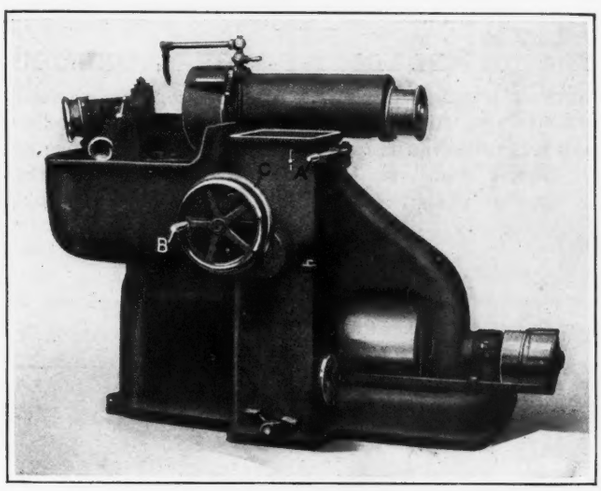



Fig. 1. Front View of No. 1 Lumsden Oscillating Tool Grinder recently introduced by Alfred Herbert, Ltd.

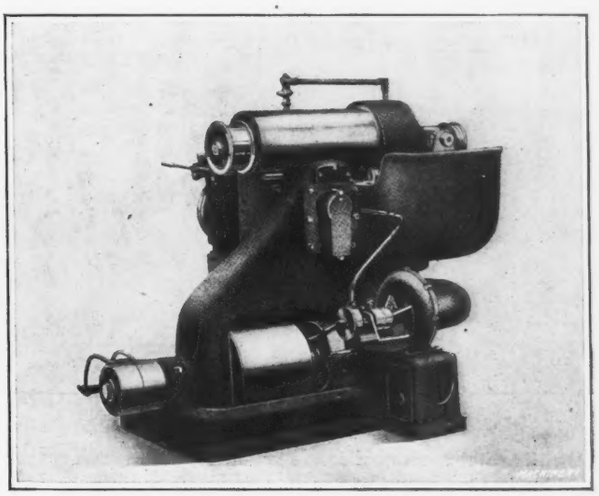


Fig. 2. Rear View of No. 1 Lumsden Oscillating Tool Grinder showing Arrangement of Dust Exhaust and Pump

This swinging movement is made use of to bring both the side and front faces into contact with the grinding wheel, and also for forming a radius on the nose of the tool.

The swiveling movement gives the rake or clearance angles required, while the rotation of the tool-holder on its own axis enables the top and side faces to be ground. The tool-holder is adjustable sidewise on both sides of the center line to allow the round nose of offset tools to be brought over the center of the vertical swinging movement. The No. 3 tool-holder has all the adjustments of the smaller sizes, in addition to which it is arranged with extra movements for accommodating many special tools used in machines for operating on armor plate and other heavy work. Adjustable stops are provided for each movement of the tool-holder, which allow duplicate tools to be rapidly shaped.

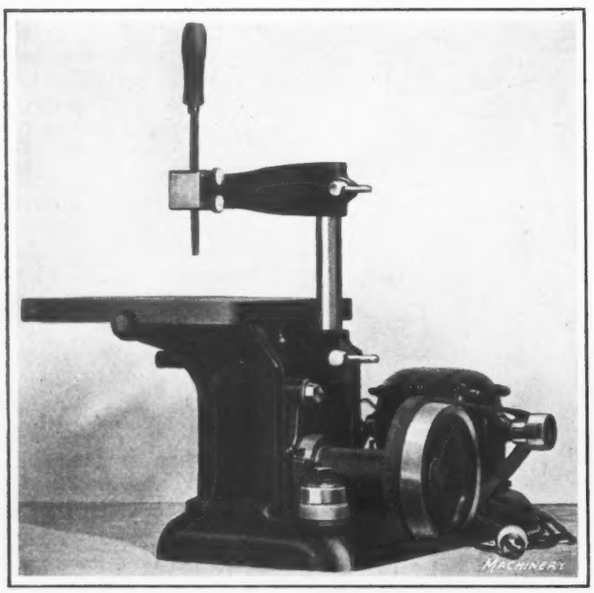
Some tools require the top cutting face to be made concave and it has been the practice to grind such curved faces by hand, using a small sized wheel. A patented curved-face attachment has been developed for use on the Lumsden

oscillating tool grinder, which enables such work to be done very rapidly. It consists of a swiveling tool-holder fitted to a lever-operated slide, the whole mechanism being arranged to fit in the tool-holder of the machine. With this equipment a curved face of any desired radius can be produced, ranging from that of the corner of the wheel up to the circumference of the wheel, by simply adjusting the slide on which the tool is carried from a vertical to a horizontal position.

Referring to the rear view of the machine shown in Fig. 2, it will be seen that an exhaust fan is provided which draws away the metal grindings and waste from the wheel, and discharges them into an exhaust duct. A water pump is also furnished. The Lumsden oscillating tool grinder is made in four sizes known as Nos. 1, 2, 2a, and 3. The No. 1 machine will grind tools with shanks ranging from ½ by ½ inch up to 1⅝ inch by 2 inches; the Nos. 2 and 2a machines will grind tools with shanks ranging from ¾ by ¾ inch up to 3 by 2 inches; and the No. 3 machine will grind tools with shanks ranging from ¾ by ¾ inch up to 6 by 3 inches.

## JOHNSON & BIDDLE FILING MACHINE

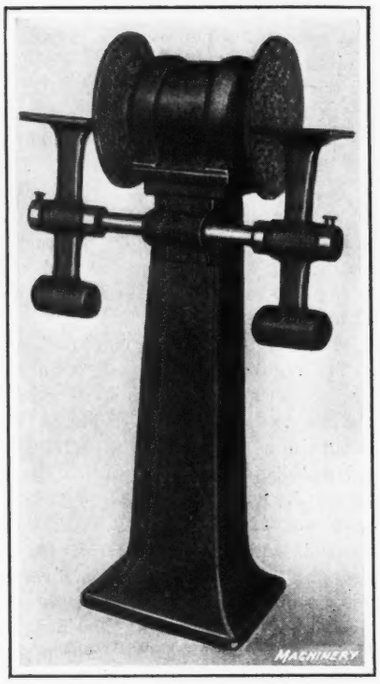
The Johnson & Biddle Tool Co., Elkhart, Ind., has recently developed a bench filing machine which is shown in the illustration that accompanies the following description. This machine has a reciprocating over-arm which will hold standard files, the method of clamping the file being so arranged that provision is made for readily adjusting and lining up the file. The same method of clamping is used on both the top and bottom of the file. Adjustment is provided for the stroke to cover a range from 0 up to 1½ inch. This machine is especially useful for filing punches and for similar work. It is motor driven and any speed may be obtained from 400 to 550 strokes per minute. The table may be tilted to angles up to 10 degrees, thus adapting the machine for filing dies and other work, on which a clearance must be provided. This machine weighs 90 pounds.




Filing Machine built by the Johnson & Biddle Tool Co.

## FORBES & MYERS DOUBLE DISK GRINDER

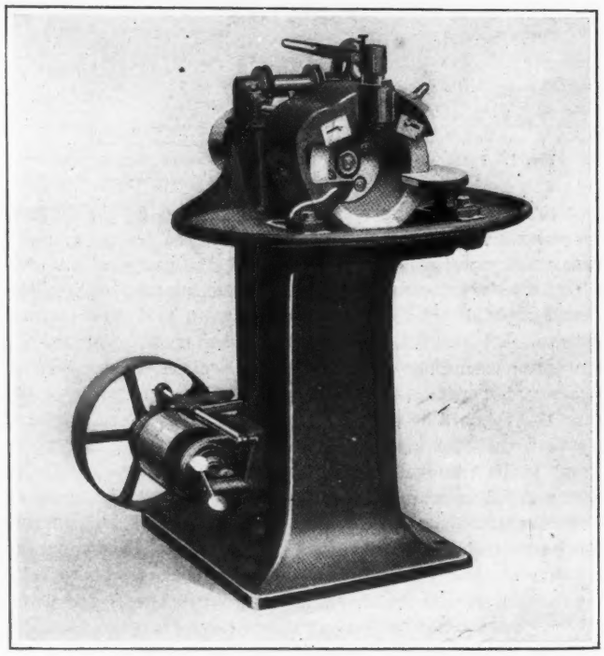
The accompanying illustration shows a disk grinding machine which has just been placed on the market by Forbes & Myers, 178 Union St., Worcester, Mass. In working out the design of this grinder, care has been taken to combine the features of simplicity and convenience of operation. The disks are 12 inches in diameter and they are made of steel with provision for driving them at 1800 revolutions per minute. It will be seen that swinging tables are provided for holding the work against the disks, so that the work may be oscillated while the grinding operation is performed; but if so desired, the work-holding tables may be held stationary by means of set-screws which clamp them to their pivotal supports. The motor used to drive this disk grinder is of the same type that is used on Forbes & Myers tool grinders. It develops a maximum of 2 horsepower and is fully enclosed. Hess-Bright ball bearings used in this machine are contained in dust-proof housings which not only exclude dirt, but also allow each bearing to be packed with a sufficient amount of grease to last for several months without further attention. The electric motor can be supplied for 2- or 3-phase alternating-current circuits of 25 or 60 cycles and of any voltage.




Double Disk Grinding Machine built by Forbes & Myers

## LUMSDEN PLAIN CUP-WHEEL GRINDER

Difficulty is often experienced in obtaining perfectly straight faces on cutting tools when they are ground on the periphery of an ordinary grinding wheel. Where tools are ground on this surface of the wheel, it is found that the faces are likely to be somewhat concave, but this trouble is effectually overcome by using the flat side face of the wheel as the grinding surface. In the accompanying illustration there is shown the Lumsden ball bearing plain cup-wheel grinder which has recently been introduced by Alfred Herbert, Ltd., 54 Dey St., New York City. This ma-



Lumsden Plain Cup-wheel Grinder introduced by Alfred Herbert, Ltd.

chine uses the flat face of the wheel for grinding, and it is equipped with a wheel dresser that is incorporated in the design to make it a self-contained unit, thus enabling the operator to keep the grinding wheel in good condition without loss of time in obtaining and adjusting an independent dresser. The tool-rests are designed to afford convenience of operation and they are adjustable for setting to the required cutting angle.

Combined radial and thrust ball bearings support the spindle, and it is driven from the self-contained countershaft which is also equipped with ball bearings. In working out the design of this machine, great care has been taken to make the bearing housings dustproof and oil-tight. The water supply is regulated by a flooding block which is raised and lowered by means of a handwheel, so that the level of the water in contact with the wheel may be varied according to the amount of water that is required. When so desired this machine can be equipped with individual motor drive, the motor being mounted directly upon the wheel-spindle. The equipment furnished with the machine includes a countershaft and Norton grinding wheel. These Lumsden grinders are made in Nos. 11 and 12 sizes, and they have grinding wheels 12 and 16 inches in diameter, respectively.

## HEALD INTERNAL GRINDING MACHINE

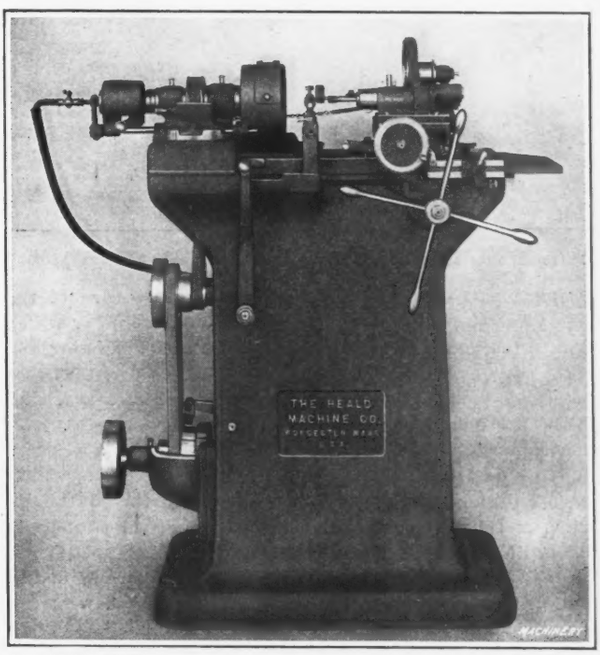
For use in grinding short work of small diameter, the Heald Machine Co., Worcester, Mass., has recently developed a No. 85 internal grinding machine. A conveniently located pilot wheel provides for imparting a hand-feed movement to the table; and there is a quick-acting collet operated by a lever for holding the work. The design has been worked out to combine the features of simplicity and strength, which are required in a production machine.

The work-head is driven by a cross-belt through the base from a four-step cone pulley giving three speeds of 161, 292 and 528 R. P. M. It is arranged to swivel and is graduated up to 45 degrees or 4 inches taper per foot. The rotation of the work-head is automatically stopped and the water shut off when the grinding wheel is withdrawn from the work, this result being brought about by a friction clutch in the base, which is operated by a lever on the front of the machine. As the table moves to the right, a small dog attached to it engages the lever and throws the clutch out. When the operator wishes to resume his work, he simply pushes the lever back into its vertical position, thus starting the work-head and water. For a machine of this size, the work-head is unusually massive. It is bolted directly to the base and is fitted with bronze bearings which are absolutely dustproof and adjustable for wear. The work-spindle is ground and lapped, the front bearing being 1⅝ inch in diameter and the rear bearing 1⅜ inch in diameter.

The work-holding fixture furnished with this machine consists of a quick-acting collet chuck with a capacity for holding pieces from ⅜ inch up to 3 inches in diameter. It is operated by a lever with an adjustable compensating device, which prevents the work from being distorted by pressure. The feed to the cross-slide is calibrated to read to 0.00025 inch. The feed-lever has been placed at the left hand of the cross-slide, enabling the operator to keep his right hand on the pilot wheel while using the left hand to feed the slide. The main table has flat and V-ways and is of unusually heavy construction for this size of machine. It is provided with a positive stop accurately governing the travel, thus enabling the operator to grind up to a shoulder or to any given point without danger of over-running.

An overhead countershaft is used, which is of unusually simple construction, having two steel hangers equipped with self-aligning ball bearings, a driving pulley, a drum for the flexible idler, and tight and loose pulleys to receive power from the main line. Attention is called to the arrangement of the wheel guard which automatically covers the wheel as it is withdrawn from the work. Even if the operator's hand should slip while plugging the work, there is no danger of his being injured. The idler pulley is fitted with ball bearings and is of a flexible type, keeping an even tension on the spindle and countershaft belts at all times.

The water equipment includes a pump, tank, water guard and connections. While the water tank and pump are of unusually generous capacity, they fit into the back of the base of the machine, requiring but a few more inches of floor space than the machine itself. This No. 85 internal grinder was designed for work ranging from ¼ inch to 2 inches in diameter by 4 inches long. It is ideal for grinding holes smaller than ¾ inch diameter by 1½ inch long. The actual swing inside of the water guard is 6 inches, while without the guard, the swing is 10 inches. This machine is equipped with a wheel-head known as the Type 10, having a solid adjustable taper bearing at the wheel end, with ball bearings at the pulley end. They are made up in units complete in themselves, each having its own pulley, thereby securing correct spindle speed. One head, known as Style




No. 85 Internal Grinding Machine built by the Heald Machine Co.

200, has different sized quills inserted into the nose of the spindle. These quills are tapered and when put in place with a slight tap on the end of the quill, they give a firm grip and practically make a part of the spindle.

The principal dimensions of the machine are as follows: Swing, 10 inches; length of base, 33 inches; dimensions of table, 35 by 8⅜ inches; height of chuck from floor, 46 inches; diameter of hole through spindle, 13/16 inch; diameter of work spindle pulley, 4 inches; speed of countershaft, 600 to 620 R. P. M.; size of tight and loose pulleys, 10 inches in diameter by 2¾ inches face width; floor space occupied by the machine, 26 by 50 inches; and net weight, 1100 pounds. Standard equipment furnished with the machine includes a countershaft, a collet chuck with adjustable jaws having a capacity from ⅜ inch to 3 inches, one grinding wheel head, one dozen grinding wheels, a pump, tank and water guards for wet grinding, a diamond and diamond bridge and the necessary wrenches for making all adjustments.

## TAFT-PEIRCE SINE-BAR FIXTURE

The sine-bar fixture manufactured by the Taft-Peirce Mfg. Co., Woonsocket, R. I., has recently been improved. In the original fixture the pivoted sine bar could be raised and lowered as well as rotated by loosening a clamping nut on the rear end of the pivot extension arm. However, each time the sine bar was either rotated, raised or lowered, this arm had to be loosened. In the new type of fixture, two

Improved Type of Sine-bar Fixture made by the Taft-Peirce Mfg. Co.

clamping nuts are provided—one which takes care of the raising and lowering of the pivot point, and the other which permits the rotation of the sine bar without changing the height adjustment of the pivot end. It is evident that this independence of adjustment will be a great time saver and will be the means of obtaining more accurate results. Another important improvement is the provision of a positive adjusting device which is mounted on the pivot arm extension. This adjustment consists of two fine thread thumb-screws and a set-screw. In operation, coarse adjustment is made with the large nuts at the back of the fixture. Then the final adjustment is made with the thumb-screws in the front. After adjustment, the pivot pin is clamped with the set-screw which holds it in its proper position.

Immediately below the sine bar and of similar dimensions is located a highly finished bar which forms a part of the base. By using this bar as one side and the lower face of the sine bar as the other side, any angle up to 90 degrees can be accurately established. The upper surface of the base in front of the sine bar is finished to form a plane at right angles to the front surface of the sine bar, the purpose of this finished surface being to furnish a base upon which measuring blocks can be stacked when measuring the perpendicular distance between the two studs of the sine bar. The fixture is a self-contained tool and once the bar is adjusted to any given angle, it can be securely clamped and then the whole mechanism as a unit can be moved about without disturbing the adjustment.

Inasmuch as it is often easier, as well as more accurate, to measure the cosine of an angle instead of the sine, the fixture is so arranged that it can be set up in one position and then turned 90 degrees for the measurement of the angle. This operation is made possible by the fact that the end surfaces of the supporting casting are furnished at right angles to the base.

## SKELTON BORING-BAR AND ELEVATING TOOLPOST

Several advantages are claimed for a new boring-bar that has recently been developed by the Skelton Tool Co., 406-408 Ash St., Syracuse, N. Y. Among these, mention is made of the fact that this bar is unusually rigid, because it is about three-fourths the diameter of the smallest sized hole that it will bore. Another feature is that the cutting end of the tool is so simply constructed that an apprentice boy can grind the tool satisfactorily. Boring-bars of this improved type are made of high-speed steel in sizes up to 1 inch in diameter, the high-speed steel cutter being electrically welded to a low-carbon steel shank. Boring-bars of sizes over 1 inch in diameter will have a high-speed steel head made separate from the bar and interchangeable for heads of other sizes.

The elevating toolpost shown in Fig. 2 is designed to give it ample strength and thus overcome having the toolpost one of the weak points on a machine tool. The clamping mechanism is so arranged that one of the new Skelton boring-bars or some other tool may be held without marring the tool. It will be apparent that the clamping device consists of a lower V-block in which the tool is located and an upper clamping member which is forced down on the tool by means of two set-screws. The toolpost swings through a complete circle and is clamped in any position by a screw that is entirely independent of those used to hold the tool in the toolpost. The elevating mechanism is also independent of other parts of the mechanism and affords over one

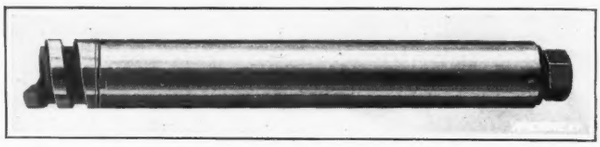


Fig. 1. Improved Type of Boring-bar made by the Skelton Tool Co.

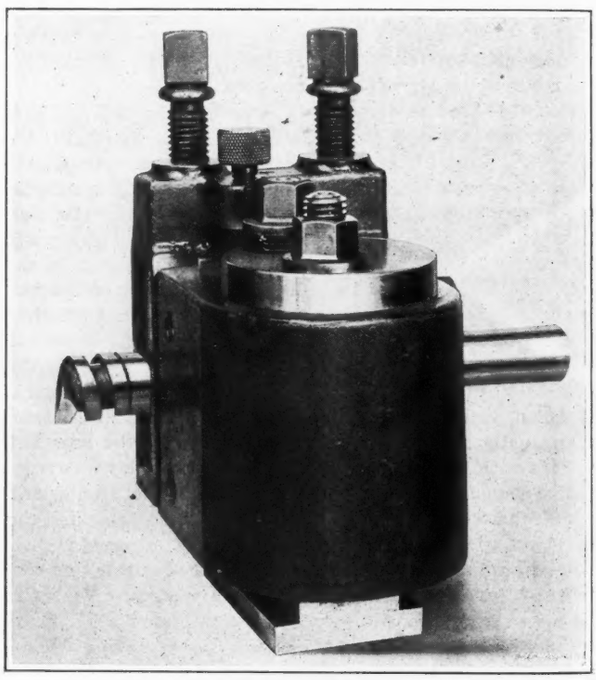


Fig. 2. Elevating Toolpost made by the Skelton Tool Co. and equipped with a Boring-bar of the Type shown in Fig. 1

inch of vertical adjustment. All parts of the post are liberally proportioned in order to afford plenty of strength and to prevent any tendency for the toolpost to vibrate under severe conditions of service.

* * *

## FRENCH IMPORT RESTRICTIONS REMOVED

It is announced on the authority of the Department of Commerce that all of the French restrictions upon the importation of machinery, machine tools, and metal-working tools of any kind have been removed. With the removal of the import restrictions, however, there has been an increase in the duties proportionate, it is stated, to the increase in the prices of machinery and tools between 1913 and 1918. So far, only cabled reports have been received and details as to the increase of duties on machine tools are not as yet available.

## NEW MACHINERY AND TOOLS NOTES

**Planer and Jointer:** Oliver Machinery Co., Grand Rapids, Mich. A planer and jointer which is equipped with a three-knife cylinder and a direct-mounted electric motor drive.

**Belt Fastener:** Sawyer Belt Hook Co., Pawtucket, R. I. A plate type of fastener for joining the ends of heavy belts. The plate is made of a single malleable casting, and in three different sizes for 10-, 12-, and 14-inch belts.

**Tool-holder:** Economy Tool Holder Co., 103 Park Ave., New York City. A tool-holder made in three pieces, comprising the holder, the vise, and the nut. Holders of this type are made straight or with a right- or left-hand offset.

**Back-geared Lathe:** Union Lathe Works, York, Pa. A 16-inch lathe which is built with beds 6, 7, 8, 10, and 12 feet in length. The machine is driven by a four-step cone pulley and single back-gears, which give eight changes of speed.

**Planer:** George Gorton Machine Co., Racine, Wis. The first of a line of planers which are to be placed upon the market by this company. They are rated at 31, 37 or 42 inches between the housings, with a capacity of 31 inches under the cross-rail.

**Grinder:** St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo. A line of heavy-duty grinders which are furnished with liberally proportioned arbors. Machines of this type are made in three sizes, using grinding wheels 18 by 3, 20 by 3, and 24 by 4 inches, respectively.

**Belt Fastener:** Flexible Steel Lacing Co., 552 S. Clinton St., Chicago, Ill. A belt fastener for use on conveyor and elevator belting. This fastener is made of steel and provides a joint of high tensile strength. Various sizes of fasteners are made for belts from ⅜ inch in thickness upward.

**Work-holding Clamps:** Keller Tool & Machine Co., Eau Claire, Wis. An improved type of holding-down block which is styled a "Never Loose" clamp. This device is bolted to a machine table and forms a ready means of securing work in place for the performance of various machining operations.

**Indicator:** Boston Tool & Mfg. Co., Inc., 262-280 Dover St., Boston, Mass. An indicator of the type known as a "wiggler," which is adapted for use on milling and drilling machine work, etc. This device consists of a cylindrical body carrying on one end a movable pointer. It will locate the true center very quickly.

**Die Filing Machine:** Boston Tool & Mfg. Co., Inc., 262-280 Dover St., Boston, Mass. A rotary die filing device which can be attached to a drilling machine or lathe or to an independent electric driving motor. When so desired, the machine can also be driven from a countershaft. It is adapted for filing dies, tools, and other work of a similar character.

**Countersink Drills:** Latrobe Tool Co., Latrobe, Pa. High-speed steel countersink drills which are made with either three or four flutes. The body is made of high-speed steel and is screwed and brazed into the tapered steel shank by means of a patented connection. These tools are made in various sizes and with points of 15, 37, 45, and 60 degrees.

**Index-centers:** W. B. Knight Machinery Co., St. Louis, Mo. A No. 2 set of index-centers which are adapted for use on the No. 2 or No. 3 combination milling and drilling machine of this company's manufacture. The index-centers are also suitable for use on other types of milling machines. They have a swing of 13¼ inches, and the spindle has a No. 10 B. & S. taper hole.

**Circular Milling Attachment:** W. B. Knight Machinery Co., St. Louis, Mo. A No. 2 circular milling attachment for use on the combination milling and drilling machines of this company's manufacture. It consists of a base carrying a table 15 inches in diameter, which is provided with four T-slots for clamping the work. The circumference of the table is graduated in degrees.

**Spur-gear Speed Reducer:** W. A. Jones Foundry & Machine Co., 4409 W. 12th St., Chicago, Ill. A line of spur-gear speed reducers which are made in single and double types. The single type of reducer is suitable for application in effecting reductions up to a ratio of 15 to 1; and for ratios of reduction ranging from 15 to 1 up to 200 to 1, the double type of reducer is employed.

**Rotary End-heating Furnace:** Standard Fuel Engineering Co., 1646 Woodward Ave., Detroit, Mich. This equipment is known as an "end-heating furnace" because it is intended for use in heating the ends of tools, and other pieces, to which the local application of heat is necessary. The furnace body consists of a revolving hearth on which the pieces of work are laid with the ends projecting into the heating chamber.

**Stud Bolt Wrench Set:** Keller Tool & Machine Co., Eau Claire, Wis. These tools are adapted for the removal of stud bolts which are difficult to take out without damaging the bolt. Outfits of this type are made in two sizes, the smaller of which contains wrenches to fit stud bolts from 1/4 to 5/8 inch in diameter, by intervals of 1/16 inch, while the larger set is made for four sizes of bolts; namely, 5/8, 3/4, 7/8, and 1 inch in diameter.

**Semi-automatic Milling Machine:** F. C. Sanford Mfg. Co., 2060 Fairfield Ave., Bridgeport, Conn. A semi-automatic milling machine adapted for milling valve heads, lock-nuts, and work of a similar nature. It has a sliding head that carries the arbor on which a gang of six milling cutters is mounted. The round table is provided with a chuck having six sets of jaws, and at the end of each cutter-head stroke the table indexes one-sixth of a revolution.

**Grinding Attachments:** S. A. Potter Machine & Tool Works, 79 E. 130th St., New York City. Two attachments for use on a bench lathe. One of these is an external grinding attachment, and the other is an attachment for grinding internal work. Both of these devices are primarily intended for use on bench lathes of this company's manufacture, but they can be applied to any lathe that is equipped with a drum type of countershaft.

**Multiple Punching Machine:** Thomas Spacing Machine Co., Fulton Bldg., Pittsburg, Pa. This machine was primarily designed for use in punching ship plates. Owing to the irregularity of spacing of the holes in these plates, they cannot be punched on a regular multiple machine. With the arrangement of sliding punches on the Thomas spacing machine, provision can be made for punching one or more holes in any desired location, without shifting the plate sidewise.

**Milling Machine:** Newton Machine Tool Works, Inc., 23rd and Vine Sts., Philadelphia, Pa. A heavy-duty horizontal milling machine which is adapted for operation under the conditions of heavy feed and speed which exist in handling the work of railroad and locomotive shops. Four changes of geared feed are provided for the table, which is operated by a spiral pinion and rack. The width between uprights is 51 inches and the length of the table is sufficient to mill work 20 feet long.

**Engraving Machine:** Engravers & Printers Machinery Co., Sag Harbor, N. Y. A Model D routing type of engraving machine which is especially adapted for engraving designs in steel or other metals, or in ivory, celluloid, etc. The operator of this machine stands directly in front of it, where both the piece to be engraved and the model from which he is working, are clearly in view. The machine is so designed that the operator can use both hands for guiding the tracer point over the model.

**Thread Tool Grinding Block:** W. C. Brooks, 1052 State St., Springfield, Mass. A block for use in grinding threading tools from square steel stock. This device is so shaped that it holds the work for grinding the 60-degree angle with the proper clearance. In addition, blocks of this kind can be made to provide for grinding the required angles on tools for various other types of threads besides the U. S. standard. This block can also be used for grinding the points of boring-bars for internal threads.

**Universal Dividing Head:** New Britain Tool & Mfg. Co., New Britain, Conn. A universal dividing head of compact design, which is adapted for the performance of a variety of operations on work which must be indexed. The spindle is locked by a special clamping device which removes all stress from the index-pin. The standard index-plates furnished with this head have four sets of holes; namely, 24, 28, 30, and 36, but special plates with either evenly or unevenly spaced holes can be furnished.

**Engine Lathe:** Sidney Machine Tool Co., Sidney, Ohio. A light pattern lathe which has the quick-change gear-box attached in a recess provided in the bed. Gears are furnished to provide for performing a wide range of thread-cutting operations, and an ample range of feeds for those classes of work for which a machine of this type is adapted. The lathe swings 14 inches and is equipped with a three-step cone pulley and double back-gears. The end thrust of the spindle is taken by a hardened and ground steel thrust bearing.

**Roll Chill-slot Saw:** Racine Tool & Machine Co., Racine, Wis. A heavy-duty high-speed saw which has been especially designed for operation on one type of "chill" that is used in casting rolls with chilled surfaces. These chills are made in the form of rings, and expansion slots have to be sawed in them. The new Racine sawing machine is capable of handling chills having inside diameters of from 20 to 33 inches and a maximum outside diameter of 50 inches. The machine makes 90 strokes per minute when equipped with belt drive.

**Air Compressor:** Stratton & Bragg Co., Petersburg, Va. A line of single-stage straight-line center-crank belt-driven air compressors, in which all moving parts of the mechanism are oiled by the splash system. The main bearings are

# Prompt Deliveries

## Brown & Sharpe
## Providence,

# on Milling Cutters

# Manufacturing Co.
## R. I., U. S. A.

lined with babbitt and bored to size, provision being made to compensate for wear. Both ends of the cylinder are water-cooled and an unloading valve is connected with the receiving tank, so that when the desired pressure is attained the valve acts automatically, holding the intake valves open and relieving the compressor.

**Adjustable Shell Reamer:** Cashman Tool Co., Waynesboro, Pa. An adjustable shell reamer which consists of three parts; namely, the body, lock-collar, and adjusting screw, in addition to the blades. In this reamer, the blades are adjusted backward instead of forward, by one adjusting screw, which is graduated to 0.001 inch. The adjusting screw is threaded right-hand, and the lock-collar left-hand. These two members interlock with each other. A double-end wrench is provided, one end of which adjusts the screw and the other end adjusts the lock-collar.

**Tire Cutting Hacksaw Machine:** Racine Tool & Machine Co., Racine, Wis. A hacksaw machine developed for use in removing the steel rims of worn-out auto truck tires from the wheels. The sawing mechanism is mounted on a base provided with a platform that may be raised or lowered to suit the size of the tire to be cut, by a ratchet-lever-driven worm operating a gear in mesh with a rack cut in the base. This machine is driven at 100 strokes per minute, and it is capable of cutting a double tire 17 inches in width off the rim in approximately ten minutes.

**Electric Rivet Heater:** American Car & Foundry Co., Berwick, Pa. This machine is known as the "Berwick" electric rivet heater. It is made in a No. 1 size having a capacity of 600 rivets per hour with diameters from ¼ to ⅜ inch and up to 2 inches long; a No. 2 size having a capacity of 500 rivets per hour with diameters from ½ to ⅝ inch and lengths up to 3½ inches; a No. 3 size having a capacity of 300 rivets per hour with diameters from ¾ to ⅞ inch and lengths up to 4½ inches; and a No. 4 size having a capacity of 150 rivets per hour with diameters from 1¼ to 1⅜ inch and lengths up to 10 inches.

**Multiple-spindle Drilling Machine:** Foote-Burt Co., Cleveland, Ohio. A 4-way semi-automatic 60-spindle drilling machine which provides an exceptionally efficient method for the performance of multiple drilling operations on four faces of a piece of work. Machines of this type are especially designed for the operation which they are to perform, and they may be built in various combinations for drilling holes simultaneously in two, three, or four sides of the work. The spindles are all set on fixed centers, which allows both the spindles and gears to be made of the greatest possible size for the conditions of operation which must be fulfilled. The jig is made a part of the machine. This multiple-spindle drilling machine is semi-automatic in operation. One lever engages the feed, and all heads advance to the work simultaneously and then return to the starting point, where the feed is automatically disengaged. An improved type of lubrication system is provided, which operates on the splash system; and the base of the machine has a compartment with capacity for holding thirty-five gallons of oil, which drains back to the reservoir through a wool filter after being distributed. All rotating parts except the spindles run on Hyatt high-duty roller bearings. Special alloys are used for making such parts as the spindles and spindle gears.

* * *

### ELECTRICALLY WELDED RIM WRENCH

An interesting application of electric welding is found in a new rim wrench brought out by the Allen Mfg. Co., Hartford, Conn., maker of the Allen safety set-screws. This wrench, which is intended for use in connection with automobile tire rims, is made in the form of a brace, provided with a hexagon socket produced in the same manner as the hexagon hole in the Allen safety set-screw. One of the main features of the wrench, however, is that the socket end is electrically welded to the brace part of the wrench, thus making it possible to make the socket from the proper kind of material to withstand wear and to be properly heat-treated. This method of making a rim wrench has been covered by patents.

## PERSONALS

H. E. Henry, formerly sales manager of the Fulflo Pump Co., Blanchester, Ohio, has become sales manager of the Michigan Machine Co., Detroit, Mich.

Arthur Jenner, formerly of the Noiseless Typewriter Co., Marlin Arms Co., and American Can Co., has returned to the Noiseless Typewriter Co. as superintendent.

Clarence E. Kinney, formerly with the Symington Properties, has become associated with Ogden R. Adams at Rochester, N. Y., as general manager and sales engineer.

Charles Oesterlein, vice-president of the Oesterlein Machine Co., Cincinnati, Ohio, sailed July 2 for a four months' tour of Europe. He will visit England, France, Spain, Italy, Switzerland, Denmark, Norway, and Sweden.

F. R. Mead, Captain, Ordnance Department, U. S. A., who was formerly head of the gage section, Inspection Division, and who recently received his discharge, has become associated with the Wilton Tool & Mfg. Co., Boston, Mass., as its eastern representative.

Ruth Edwards has resigned her position as treasurer of the Bantam Ball Bearing Co., Bantam, Conn., after many years of service with the company, and Mrs. E. J. Schoonmaker has been promoted from the cost accounting department to the treasurership.

William A. Nugent, who served with the Twenty-first Engineers in the United States Army, has returned from France and resumed his duties with the Independent Pneumatic Tool Co., Chicago, Ill., as traveling representative. He has been assigned to his old territory in Indiana.

L. K. Goss has joined the sales force of the Tacony Steel Co., Tacony, Pa., and will act as assistant to Mr. Keefer, the Cleveland district sales manager. Mr. Goss, who has just left the Ordnance Department, was formerly manager of the small tool department of the Warner & Swasey Co.

Ernst Richter, for thirty-one years chief engineer and designer for the G. A. Gray Co., Cincinnati, Ohio, builder of metal planers, has retired from active service, but will still continue to serve the company in an advisory capacity. Forrest E. Cardullo has been appointed engineer and designer in his place.

Samuel S. Buckley and Edgar D. Newkirk, president and secretary-treasurer, respectively, of the Onondaga Steel Co., Inc., Syracuse, N. Y., have returned from France. They sailed for France late in May and spent the month of June in that country, studying general conditions, particularly those in the steel industry.

B. M. W. Hanson, until recently vice-president and works manager of the Colt's Patent Firearms Mfg. Co., Hartford, Conn., and previously similarly connected with the Pratt & Whitney Co., has, in conjunction with Clarence E. Whitney and F. W. Young, also of Hartford, formed the Hanson-Whitney Mfg. Co., of which Mr. Hanson will become president. The new concern will engage in the designing and manufacturing of machine tools.

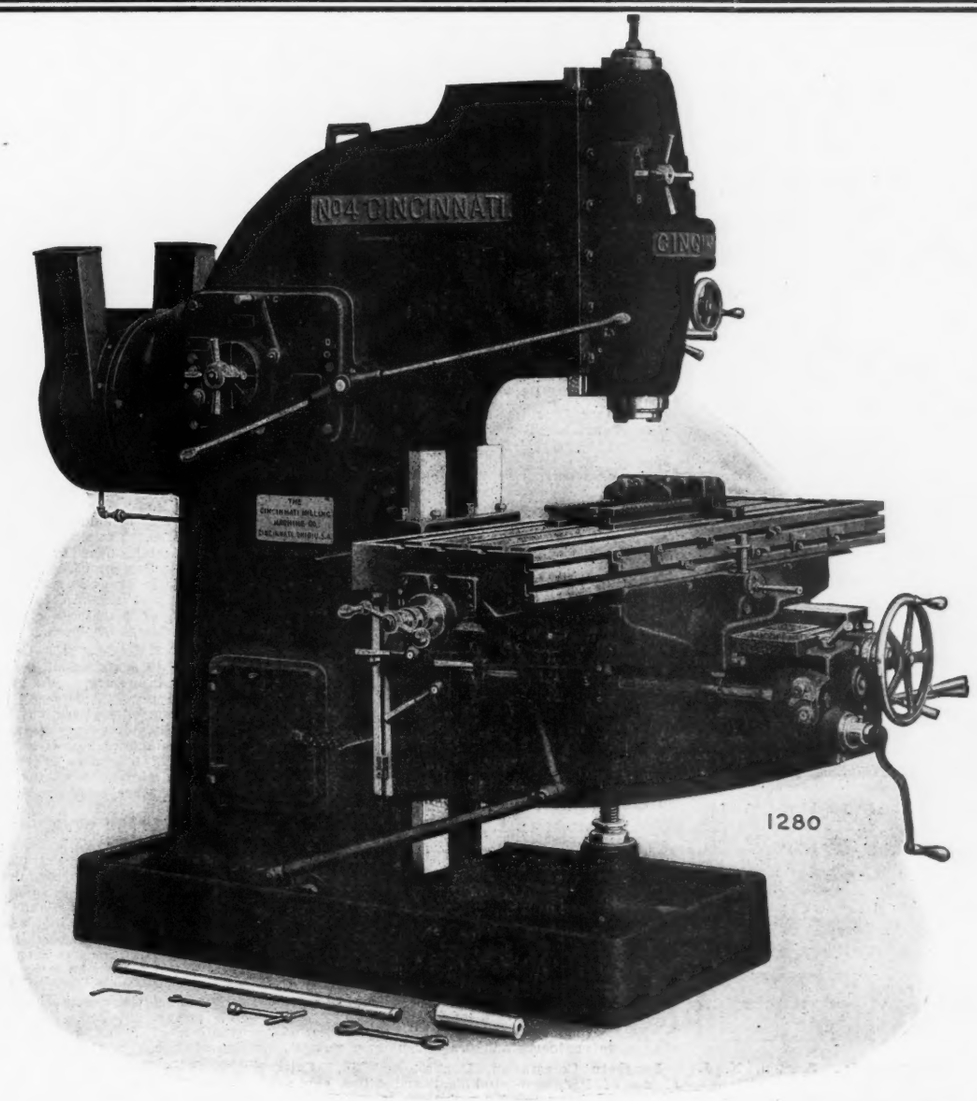
A. L. Valentine, for the past nineteen years connected with the Small Tool Department of the Pratt & Whitney Co., Hartford, Conn., the last fifteen years of which he was superintendent, has left this company and will become works manager of the Société des Usines Curial, of Paris, France, a company which is understood to be making plans to engage extensively in the manufacture of small tools. Mr. Valentine sailed for France July 19 on the *Espagne*.

George G. Porter, one of the founders of the Porter-Cable Machine Co., Syracuse, N. Y., has severed his active connection with that company and has opened offices as consulting mechanical engineer and factory organizer in the new Keith Theater Building, Syracuse, N. Y. Mr. Porter will engage in the designing and drafting of special and automatic machinery, tools, dies, jigs, and fixtures, and will conduct an engineering and sales service, developing ideas and putting them on a manufacturing basis.

C. S. Coler has been appointed manager of the Educational Department of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. Mr. Coler graduated from Cornell University as an electrical engineer in 1911, after which he entered the graduate student course of the Westinghouse Electric & Mfg. Co. He has been director of mechanical drawing in the Casino Technical Night School, and previous to his present appointment, was manager of the entire evening school and director of trades training of the Westinghouse company.

## OBITUARIES

Oscar Otto, general superintendent of the South Philadelphia Machine Works of the Westinghouse Electric & Mfg. Co., died June 30 as the result of injuries received in an automobile accident. Mr. Otto was born in Manitowoc, Wis., in 1859. After finishing his apprenticeship course as a machinist in the Manitowoc shops of the Chicago & Northwestern Railroad, he became associated with the Northern Pacific Railroad Co. at Tacoma, Wash., going from there to the Oregon Short Line at Salt Lake City. In 1898 he returned to the Chicago & Northwestern Railroad as superintendent of the Chicago shops and in 1909 became general superintendent of the Westinghouse Electric & Mfg. Co. at East Pittsburg, Pa. When the plant at Essington, Pa., was opened he was transferred to the new works.




# The New No. 4 Vertical Cincinnati Miller

**(Patent Rights Fully Reserved)**

*Some of its big productive features are—*

Intermittent Feed.
Power Quick Traverse in Both Directions.
Square Gibbing with Narrow Guides.
Feed Changes at Front of Knee.
Safety Couplings in Feed Transmissions.
Individual Feed Control Levers.
Automatic Lubrication.
Centralized Oiling.
Flooded Lubrication for Cutter and Work.
Hardened Sliding Gears Throughout.
Starting Lever at Front.
Automatic Break.
Spindle Can Run in Either Direction.
Spindle Driven Through Spur Gears.
Face Gear of Large Diameter for Large Cutters at Slow Speeds.
Secondary Spindle Gear Provided for Small Cutters at Fast Speeds.
Spindle Gears Keyed to Sleeve, which is Keyed to Spindle at its lower end.
Back Gears Slide on Hardened Shaft having Four Integral Keys, and Automatically Maintain Proper Driving Relation for All Positions of Vertiçally Adjustable Spindle Head.

*Ask for descriptive matter*

## THE CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio

## COMING EVENTS

**August 19-21**—Annual convention of the International Railroad Master Blacksmiths' Association in Chicago, Ill.

**August 28**—Monthly meeting of the Rochester Society of Technical Draftsmen, in Rooms 131-137 Sibley Block, 328 Main St., E., Rochester, N. Y. Secretary, O. L. Angevine, Jr., 547 Arnett Blvd., Rochester, N. Y.

**August 29 - September 1** — Eastern Association School, Industrial Conference at Silver Bay, Lake George, N. Y. Convention under the auspices of the international committee of the Young Men's Christian Association's Industrial Department, to deal with "Human Relations and Betterment in Industry." William H. Woodin, chairman promotion committee of conference, 347 Madison Ave., New York City.

**September 16-19**—Annual meeting of the Traveling Engineers' Association in Chicago, Ill.; headquarters, Hotel Sherman. Secretary, W. O. Thompson, General Offices, N. Y. C. R. R., Cleveland, Ohio.

**September 22-27**—First annual convention and exhibit of the American Steel Treaters' Society in Chicago, Ill. Business manager, W. H. Eisenman, 154 E. Erie St., Chicago, Ill.

**September 29-October 4**—Eighth annual congress of the National Safety Council at Cleveland, Ohio.

**September 29-October 4**—Twenty-fourth annual meeting of the American Foundrymen's Association and fourteenth annual exhibit of foundry and machine shop equipment and supplies in Philadelphia, Pa. Secretary, C. E. Hoyt, 111 W. Monroe St., Chicago, Ill.

**February 2-6, 1920**—First annual mechanical inspection equipment exposition and convention of the American Society of Mechanical Inspectors at the Hotel Astor, New York City. Secretary, Henry F. Winter, 35 W. 39th St., New York City.

## SOCIETIES, SCHOOLS AND COLLEGES

**Polytechnic Institute of Brooklyn**, 85 Livingston St., Brooklyn, N. Y. Catalogue covering courses in the College of Engineering for 1919-1920.

**School of Mines and Metallurgy of the University of Missouri**, Rolla, Mo. Bulletin containing catalogue for 1918-1919 and calendar for 1919-1920, covering courses of study and other related information.

## NEW CATALOGUES AND CIRCULARS

**John A. Roebling's Sons Co.**, Trenton, N. J. Circular of Roebling wire rope.

**Griscom-Russell Co.**, 90 West St., New York City. Bulletin 228 illustrating and describing the Reilly water distiller.

**Rockford Machine Tool Co.**, Rockford, Ill. Circular illustrating and giving specifications for the Daniels automatic lathe.

**Peter A. Frasse & Co., Inc.**, 417-421 Canal St., New York City. Stock lists of Frasse steels and Shelby seamless steel tubing.

**Frontier Chuck & Tool Works**, 30 Letchworth St., Buffalo, N. Y. Circular illustrating and describing the Lavoie fluid-operated chuck.

**Texas Co.**, Houston, Tex. Catalogue entitled "Texaco at Home and Abroad," treating of "Texaco" lubricating oils—their production and marketing.

**Moltrup Steel Products Co.**, Beaver Falls, Pa. Specification sheet for Moltrup flattened steel foundry pattern plates for mounting split or matched patterns.

**Armstrong Cork & Insulation Co.**, Pittsburg, Pa. Circulars treating of "Nonpareil" corkboard insulation for cold storage rooms and freezing tanks, and "Nonpareil" cork covering for drinking water systems.

**Advance Tool Co.**, Cincinnati, Ohio. Catalogue B containing tables of dimensions and prices of this company's line of small tools, including milling cutters, end-mills, counterbores, reamers, arbors, mandrels, gages, etc.

**Kempsmith Mfg. Co.**, Milwaukee, Wis., is issuing a booklet for its employes, entitled "Working with the Kempsmith Mfg. Co.," which contains shop rules and other information of interest and value to the employes.

**R. G Haskins Co.**, 547 W. Washington Blvd., Chicago, Ill. Circular illustrating and describing motor-driven bench and floor type grinding machines, which can be furnished for 110 or 220 volts, direct or alternating current.

**Warner Elevator Mfg. Co.**, Cincinnati, Ohio. Circular showing interior views in the company's plant, and a few of the company's products, including automobile hoists, traction type freight elevators, and automatic push-button dumbwaiters.

**Holz & Co., Inc.**, 17 Madison Ave., New York City. Bulletin 4, describing a machine for determining the resistance of metals and alloys to abrasion, applicable to rolling or sliding surfaces —dry or lubricated—under variable speeds and pressures.

**Standard Spiral Pipe Works**, 2531-2561 W. 48th St., Chicago, Ill. Catalogue 7, covering this company's line, which includes smooth-bore reinforced spiral pipe, valves, cast-iron fittings, special steel fittings, hydraulic supplies, forged steel flanges, and drop-forgings.

**Electric Hoist Manufacturers Association**, 9 E. 40th St., New York City, has recently published a booklet entitled "Facts for Operators of Electric Hoists." Copies can be obtained by applying to the secretary, W. C. Briggs, 30 Church St., New York City.

**American Machine Tool Engineering Works**, 4854 W. Kinzie St., Chicago, Ill. Circular illustrating and describing the "Hack" high-power universal relieving machine, which is made in three sizes, having capacities of 4, 8, and 12 inches, respectively.

**Container Club**, 608 S. Dearborn St., Chicago, Ill. Pamphlet illustrating and describing the Webb box tester for testing corrugated fiber boards. The pamphlet contains a statement of what the instrument is capable of doing, as shown by a series of tests.

**Albert Kingsbury**, Pittsburg, Pa. General catalogue descriptive of the construction and principle of operation of Kingsbury thrust bearings. The catalogue gives the results of tests that have been made on these bearings and illustrates a number of applications on various classes of work.

**Black & Decker Mfg. Co.**, Baltimore, Md. Catalogue (8½ by 11 inches) of Black & Decker electric air compressors, portable electric drills, and electric valve grinders. Specifications for the different sizes are given, and the tools are fully illustrated with either full-page or half-page views.

**Loshbough-Jordan Tool & Machine Co.**, Elkhart, Ind. Circular giving specifications for the line of power presses produced by this company, including two new sizes that have recently been brought out—the No. 1 size having a capacity of 10 tons, and the No. 2 size having a capacity of 14 tons.

**Smalley-General Co., Inc.**, Bay City, Mich. Circular entitled "Fundamentals of Thread Milling," treating of the salient features of thread milling in a non-technical way. It describes, in addition, the general construction of single-purpose and general-purpose thread milling machines and the work for which they are adapted.

**Wellman-Seaver-Morgan Co.**, Cleveland, Ohio. Bulletin 22 containing charts giving relative power, diameter, torsional stress, and speed of shafts. Three graphic charts are given, and examples, showing method of use. The company is distributing copies of this bulletin, free of charge, to engineers and draftsmen upon request.

**Pangborn Corporation**, Hagerstown, Md. Catalogue of Pangborn sand-blast and allied equipment, containing brief descriptions of the various types and sizes, covering the basic principles, individual features, and capacities. The catalogue has been condensed for the convenience of readers, but detailed information on any of the units will be sent promptly upon request.

**Onondaga Steel Co., Inc.**, Syracuse, N. Y. A color chart showing the colors for different temperatures, and circular entitled "Save High-speed Steel Scrap," giving directions for the treatment of Onondaga high-speed steel, including cutting for tool lengths, forging, hardening forged tools, hardening milling cutters and finished tools, tempering, and annealing.

**Bastian-Blessing Co.**, W. Austin Ave. at La Salle St., Chicago, Ill. Catalogue of "Rego" welding and cutting apparatus, containing a list of the parts comprising the various welding and cutting outfits, and giving prices. Several models of torches, special-purpose tips, manifolds, etc., have been added to the line, and are shown for the first time in this catalogue.

**Kempsmith Mfg. Co.**, Milwaukee, Wis. General catalogue, which is issued in sectional form comprising a collection of four-page circulars, covering the line of plain, universal, and production milling machines and attachments made by this company. The catalogue contains illustrations of the various types of machines and attachments, brief descriptions, and specifications.

**Smalley-General Co., Inc.**, Bay City, Mich. Circular giving time studies and results obtained in performing four operations on Smalley-General thread milling machines. Particular attention is called to the application of the No. 23 single-purpose thread milling machine to a production job. Circulars illustrating and describing the Smalley-General No. 23 and No. 24 thread milling machines, respectively.

**Hannifin Mfg. Co.**, Chicago, Ill. Catalogue of Hannifin "Aero" chucks, containing illustrations showing the details of this line of air-operated chucks, countershafts, vises, arbor presses, mandrels, etc. A number of special air-operated chucks, clamping devices, and expanding mandrels are also shown. The book is illustrated with halftones and detailed line drawings showing the construction of the equipment.

**Clark Tructractor Co.**, Chicago, Ill. Catalogue illustrating and describing the Clark "tructractor," which is a power-operated machine intended to replace wheelbarrows, hand trucks, and other hand-operated means of factory transportation. The "tructractor" has a carrying capacity of 1½ ton. Among the advantages claimed for this type of truck are simple design, flexibility of control, and low upkeep and operating cost.

**Green Engineering Co.**, East Chicago, Ind. Publication entitled the "Green Book—Progressive Combustion," comprising a treatise on the analysis and characteristics of coal, and its economical combustion. The book describes in detail the Green chain grate stoker for progressive combustion, and presents considerable general information of value to the power plant engineer, covering fundamentals of combustion, furnace design, etc.

**Davis-Bournonville Co.**, Jersey City, N. J., has resumed the publication of its house organ "Autogenous Welding," which was discontinued for four years due to the pressure of war work. Besides the personal items relating to the organization, the July number contains a number of interesting articles on oxy-acetylene apparatus, suggestions concerning its use, operations accomplished by the oxy-acetylene welding process and other allied information.

**Allied Machinery Co. of America**, 51 Chambers St., New York City. Catalogue Section 10000, dealing with machine tool production in the United States. The book contains general matter on the establishment of the machine tool industry; introduction of high-speed steels and the manufacturing of automobiles; trend of machine tool design and manufacturing methods; and the distribution of machine tools through the Allied Machinery Co. of America.

**R. D. Nuttall Co.**, 2133 Conway Bldg., Pittsburg, Pa. Circular entitled "Pedigreed Gears," containing information on the Nuttall tractor gears. The term "pedigreed" refers to the company's system of registration, by means of which a record is kept of every gear, showing the steel analysis, method of heat-treatment, and strength, hardness, and toughness of the steel after treatment. The circular contains illustrations showing tests that are made on these gears to insure that they will stand up under the severe conditions of service for which they are intended.

**Ferracute Machine Co.**, Bridgeton, N. J. Catalogue 21, covering the Ferracute line of presses for cutting, horning, wiring, drawing, redrawing, embossing, coining, drop-forging, punching, shearing, and stamping sheet and bar metals. The catalogue gives complete data including size, capacity, and other essential information for the entire line. The book has been carefully arranged so that the data can be conveniently referred to. Considerable general information of value has been given relating to pressures required for given work, power required, belt capacity, accident prevention, etc., and a glossary of some of the technical terms used in the press and die industry is included.

**R. K. LeBlond Machine Tool Co.**, Cincinnati, Ohio. Catalogue of LeBlond heavy-duty milling machines, 113 pages, 9 by 11½ inches. The catalogue describes in detail all the parts of the machines and the various attachments, the construction being clearly illustrated by halftones and line engravings. Illustrations are also shown of the different types and sizes of plain and universal milling machines, specifications being presented opposite the illustration in each case. Considerable space is given to a description of the LeBlond dividing head, systems of indexing, and care and adjustment, including tables for spacing on the LeBlond dividing head. The book describes tests for determining accuracy, and concludes with information on the oiling and adjustment of the machines and instructions for setting up.

## TRADE NOTES

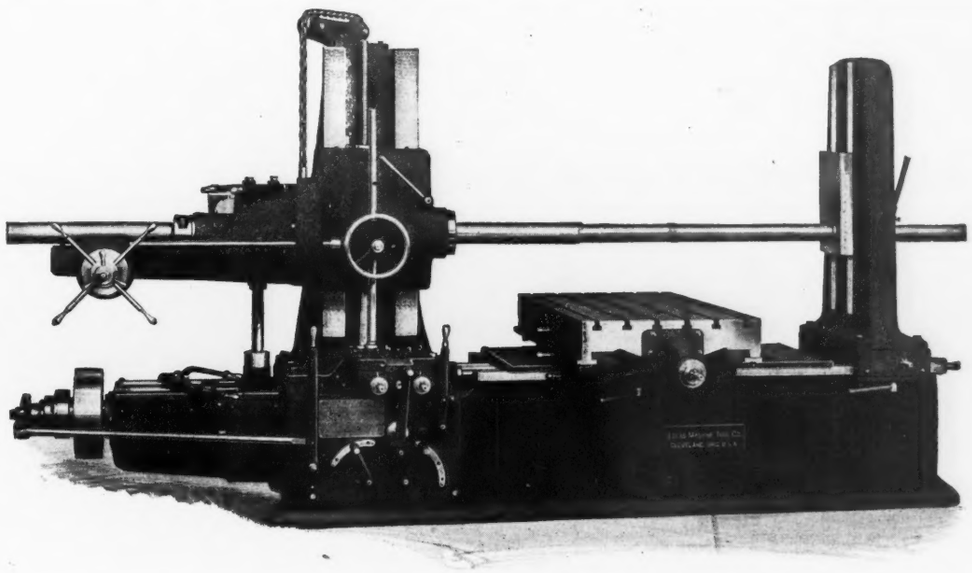
**Gale-Sawyer Co.**, 33-37 Wormwood St., Boston, Mass., has opened an office in Detroit, Mich., Room 601, Temple Bldg., 27 Monroe St., with E. H. Anthony in charge.

**Walter A. Zelnicker Supply Co.**, St. Louis, Mo., has added 2000 square feet to its present office space at 325 Locust St., which represents an increase of one-third of the former space.

**Terkelsen & Wennberg**, 326 A St., Boston, Mass., are now New England representatives for the "Eclipse" roller bearing drill chuck, manufactured by the Neilsen-Barton Chuck Co. of Chicago, Ill.

**H. E. Barton Tool Co.**, 106 S. Jefferson St., Chicago, Ill., has taken the Chicago agency for the T-W independent lathe chucks, manufactured by Terkelsen & Wennberg of Boston, Mass. All sizes are carried in stock.

**Allen Motor Co.**, which was formerly located at Fostoria, has moved to 400-412 Dublin Ave., Columbus, Ohio. The motor plant of the company is still located at Bucyrus, Ohio, but all mail should be sent to the Columbus address.



Have you noticed how few

LUCAS

# "PRECISION"

## Boring, Drilling and Milling Machines

appear on the second-hand lists?

Those that have them usually *keep* them, and the few that appear on the second-hand lists *don't stay long.*

***See the Point?***

**LUCAS MACHINE** (NOW AND ALWAYS OF) **TOOL COMPANY**

**CLEVELAND, OHIO, U. S. A.**

**Watson-Stillman Co.**, has removed its general sales and advertising departments from Aldene, N. J., to 50 Chruch St., New York City, and requests that all correspondence pertaining to sales, advertising, and publicity be sent to the latter address.

**Chicago Mica Co.**, Valparaiso, Ind., at its recent annual meeting, elected the following officers: A. W. Pickford, president; L. L. Fleig, vice-president; and John F. Griffin, secretary-treasurer. These men have taken over a majority interest in the company.

**Cleveland Milling Machine Co.**, Cleveland, Ohio, announces that the General Tool & Supply Co., Saginaw, Mich., will represent the company in the Saginaw district. A stock of milling machines and a large supply of cutters will be carried in the Saginaw office.

**Central Steel Co.**, Massillon, Ohio, has opened offices in Detroit in the Book Bldg., 35-57 Washington Blvd., Rooms 948-950. Arthur Schaeffer, formerly assistant director of sales, has been appointed district manager of sales, with Frank Gibbons as his assistant.

**State Machine & Tool Works, Inc.**, 154 Grand St., New York City, has been reorganized and will hereafter be conducted under the name of the Interstate Mechanical Laboratories, Inc. The new company will take over all the interests and obligations of the former company.

**National Tool Co.**, Cleveland, Ohio, has recently opened a New York sales office at 50 Church St., Room 553, with E. S. Chamberlain in charge. The Philadelphia branch office has been moved from 11 N. 6th St. to 40 N. 7th St. H. L. Mather is in charge of the Philadelphia office.

**New Departure Mfg. Co.**, Bristol, Conn., manufacturer of ball bearings, has instituted a 48-hour week with a 10-per cent increase in wages, and time and a half for overtime, in addition to granting every employe who has been in the company's employ three months or more, two days off with pay.

**Cincinnati Ball Crank Co.**, Cincinnati, Ohio, has made arrangements with C. H. Clark, 60 Grand St., New York City, whereby the Cincinnati Ball Crank Co. will make and market the Clark compression coupling (patents for which are now pending) under the name of the Cincinnati compression coupling, in Cincinnati.

**Electric Furnace Co.**, Alliance, Ohio, has recently installed a battery of two Baily electric furnaces of the standard 105-kilowatt tilting type at the Capital Brass Works, Detroit, Mich. The company has also installed Baily electric furnaces in the plants of the Buick Motor Co., Flint, Mich., and the Akron Bronze & Aluminum Co., Akron, Ohio.

**Gauld Supply Co., Inc.**, Portland, Oregon, has taken over the business of the Gauld Co. of Portland. The directors of the new company are William P. F. Ayer, president; Thomas Nickerson, vice-president; G. A. Ricker, treasurer; Theodore W. Little; and Carl T. Heller, all of whom are connected with the Walworth Mfg. Co., Boston, Mass.

**Stockbridge Machine Co.**, Worcester, Mass., manufacturer of Stockbridge shapers, has recently opened a New York office jointly with the Reed-Prentice Co. and the Whitcomb-Blaisdell Machine Tool Co., at 24 Stone St. The Becker Milling Machine Co., and the Giddings & Lewis Mfg. Co. will also be represented in the office. L. S. Devos is in charge.

**Atlas Press Co.**, Kalamazoo, Mich., manufacturer of hand- and power-operated arbor presses, has moved into its new factory on N. Pitcher St., Kalamazoo, which affords considerably increased manufacturing facilities. The new factory is of one-story steel and brick construction, 260 by 60 feet, thoroughly modern in every respect, and with a two-story attached office building.

**Cleveland Milling Machine Co.**, Cleveland, Ohio, has made the following changes in its organization: W. E. Millar has been appointed Pittsburg district manager; L. H. Mesker, vice-president of the company, has turned over the duties of sales manager to H. I. Miner; and the J. Horstmann Co. has been appointed French agent for the company, under the personal direction of Henri Nourry.

**Union Switch & Signal Co.**, Swissvale, Pa., announces that the 9-cylinder rotary aircraft engine built by the company has been very highly commended by the chief of the engine production, United States Army, and, in fact, has been pronounced by him as the best rotary engine ever built. High-grade nickel steel was used in the forgings, which were made in the shops of the Union Switch & Signal Co.

**Federal Machine & Welder Co.**, Warren, Ohio, has recently opened offices in Cleveland, Ohio, in the Garfield Bank Bldg., Euclid Ave., Rooms 401-402. Arthur B. Sonneborn and his assistant, Fred C. Wilder, will have charge of the Cleveland office. Mr. Wilder will devote his entire attention to the Ohio territory, and Mr. Sonneborn will continue to give most of his attention to the Detroit office, at 1516 Ford Bldg., Detroit, Mich.

**Heald Machine Co.**, Worcester, Mass., has moved its Detroit sales office from 911 Majestic Bldg. to 401 Marquette Bldg., 75 W. Congress St. J. G. Wonn will continue in charge. The company will carry samples of each of its machines and chucks at this office, together with a supply of miscellaneous parts so that customers in that territory can obtain repair parts from Detroit, and will not have to send to Worcester for them.

**Billings & Spencer Co.**, Hartford, Conn., maker of drop-forgings, tools, and drop-forging machines, has installed a group insurance system in its plant by which each employe who has been in the employ of the company for three months is insured for $500, which is increased at the end of one year's service to $750, and at the end of two years, to $1000. An extra $100 is added for each year of service until the maximum of $1500 has been reached.

**Vulcan Engineering Sales Co.**, Chicago, Ill., sales agent for the Hanna Engineering Works, Mumford Molding Machine Co., Q M S Products, and the J. C. Busch Co., has been dissolved, and all business formerly done by the Vulcan Engineering Sales Co. as sales agent will be transacted by the Hanna Engineering Works. It is believed that this arrangement will enable the company, by dealing directly, to serve the trade more promptly and efficiently.

**Clark Equipment Co.**, 1415 Railway Exchange, Chicago, Ill., manufacturer of "Celfor" high-speed drills and precision tools, has erected what is said to be the largest outdoor sign ever constructed, at its Buchanan, Mich., plant. The sign is visible for more than a mile in each direction, and can be seen at night as well as at day, being illuminated by twelve 750-watt mogul nitrogen lamps. It is 190 feet long, 40 feet high, and has an area of 6480 square feet.

**Detroit Reamer Salvage Co.**, 818 W. Warren St., Detroit, Mich., has changed its name to the Grinding Process Tool Co. The company was organized six years ago to engage in the remanufacturing of worn-out reamers, but the business has since been expanded to include all kinds of precision metal-cutting tools. The capital of the firm has been substantially increased. The officers are S. A. Cogsdill, president; W. W. Blakely, secretary-treasurer; and Ray G. Lambe, sales manager.

**Michigan Machine Co.**, Detroit, Mich., designer and manufacturer of special machines and tools, will manufacture a complete line of pumps ranging in size from ⅛ inch intake and discharge to 2 inches intake and discharge. These pumps are intended primarily for use in connection with machines and tools, for cutting tool lubrication and forced-feed lubrication of bearings, and are also adaptable for oil circulation on tractors, marine engines, fuel systems of all kinds, brine circulation, and many other uses.

**Julius Blum & Co.**, 510-512 W. 24th St., New York City, has found it necessary, owing to its greatly increased business, to enlarge its facilities, and has leased for a long term of years a building at 532-540 W. 22nd St., which is 100 by 125 feet, five stories high, with basement. The building will be reconstructed to fit the requirements of the company, and the ground floor will be built up to a height of 18 feet so that an overhead traveling crane, and other modern labor-saving devices, can be installed.

**Cutler-Hammer Mfg. Co.**, Milwaukee, Wis., has recently opened an office in Detroit, located at 905 Kresge Bldg., to expedite the handling of orders and to give the company's customers in and about Detroit better engineering service. The Detroit office is a branch of the Chicago office and bears the same relation to it as the Cincinnati office does. H. S. Kinsley, who is in charge at Detroit, has taken with him from the Chicago office, C. W. Greenman and M. Dugliss, both of whom were recently mustered out of service.

**Quick Action Chuck Co.**, Grand Rapids, Mich., announces that the Wolverine Brass Works, of Grand Rapids, have taken over the manufacture and sale of "Quick Action" chucks and collets for the United States and Europe. It is the intention of the Wolverine Brass Works to manufacture a complete line of "Quick Action" collet type chucks and collets. A number of improvements will be made in the general design of these chucks. The company has installed modern equipment and expects to be in a position to make deliveries about September 1. The sales department will be under the charge of J. R. Plank.

**Erie Crucible Steel Co.**, Erie, Pa., has recently appointed George W. Way, 858 Penobscot Bldg., Detroit, Mich., as its Michigan representative. Mr. Way is well known in the Detroit district, having been connected with the Detroit office of the Carnegie Steel Co. for five years. M. A. Palmer Co., 469 Atlantic Ave., Boston, Mass., has been appointed New England agent of the company. The Tidewater Steel Products Corporation, 149 Broadway, New York City, has been appointed agent for the metropolitan and Philadelphia districts, and D. A. Bonitz, 1816 Fisher Bldg., Chicago, Ill., agent for the Chicago district.

**New York Testing Laboratories**, which have been organized by L. R. Seidell, G. B. Jack, Jr., and H. H. Geist, formerly chief metallurgist, assistant chief metallurgist, and chief chemist, respectively, of the Wright-Martin Aircraft Corporation, have opened a New York office at 74-80 Washington St., in addition to their laboratories at 354 Mulberry St., Newark, N. J., for chemical and physical testing, and microphotography. The organization will specialize in the source inspection of metals, and as consultants in smelting, foundry, drop-forging, and heat-treatment practices, and metallurgical investigation of shop troubles.

**Rickert-Shafer Co.**, Erie, Pa., manufacturer of machinery and tools, is planning to erect another wing to its factory building, 33 by 150 feet, comprising two stories of steel and brick factory construction. The addition has been made necessary by the heavy demand for the Boehm automatic die-head and the R & S tapping machine. Orders have been placed for some new machine tools, but the large part of the machine tool requirements will not be filled until the building is completed. Plans are being made to install an up-to-date hardening department. The company expects to put several new tools on the market.

**Dalton Mfg. Corporation**, 1915 Park Ave., New York City, maker of the "Dalton Six" lathes, which has been located in New York City for the past six years, has purchased several acres of ground at Sound Beach, Conn., where a new factory will be erected to take care of the company's increasing business. The contract for four buildings and a power house has been placed with Richard Deeves & Son, New York City. It is expected that the new factory will be ready for occupation January 1, 1920, at which time the company will also be prepared to supply to the trade its new machine known as the "Dalton Six," Type B-6.

**Winter Bros. Co.**, Wrentham, Mass., manufacturer of taps and dies, has installed a course of training in modern production methods in its plant with a view to improving production conditions by developing the supervising abilities of the foremen. A group of twenty-two foremen has been organized to take this course by J. E. Winter, president of the company. John E. Calder is director of the course for the Business Training Corporation, 185 Madison Ave., New York City which is conducting the work. The course will be of two or three months' duration, the object being to train the foremen in the principles of efficient production and of handling labor.

**Hanson-Whitney Mfg. Co.**, Hartford, Conn., has been organized by B. M. W. Hanson, Clarence E. Whitney, and F. W. Young, all of Hartford, Conn., for the purpose of designing and manufacturing machine tools. The temporary offices of the company will be in the new Park St. Building of the Billings & Spencer Co., now being erected. These quarters will also be permanently occupied by Mr. Hanson as engineering offices. The new firm is capitalized at $100,000 as a beginning, and the officers are as follows: President, B. M. W. Hanson; treasurer, Clarence E. Whitney; secretary and general manager, F. W. Young. These three men also constitute the board of directors.

**Metallo Gasket Co.**, 16-20 Bethany St., New Brunswick, N. J., has recently been incorporated to manufacture a line of gaskets and other packings. The officers of the company are Zeno Schultes, president and treasurer; George Geipel, vice-president; and Stanley S. Geipel, secretary. Zeno Schultes was manager of the Goetze Gasket & Packing Co. for about fourteen years, George Geipel has been an erecting engineer for about thirty-five years, specializing in refrigerating and steam power plants, and Stanley S. Geipel has had ten years' experience in mechanical engineering. The company will concentrate for a time on the production of "Metallo" corrugated copper gasket with asbestos cord inlaid in the copper grooves.

**Ohio Electric & Controller Co.**, 5900 Maurice Ave., Cleveland, Ohio, has appointed the following firms as its representatives: Iron & Steel Equipment Co., 1502 First National Bank Bldg., Pittsburg, Pa.; Williams, Beasley Co., 343 S. Dearborn St., Chicago, Ill.; Linn O. Morrow, 707 Franklin Trust Bldg., Philadelphia, Pa.; J. W. Dopp & Co., 18 Columbia St., Detroit, Mich.; Kelly, Powell, Ltd., 403 McArthur Bldg., Winnipeg, Canada; Wonham, Bates & Goode, Inc., Dominion Express Bldg., Montreal, Canada; Shook & Fletcher Supply Co., Birmingham, Ala. Wonham, Bates & Goode, Inc., 17 Battery Place, New York City, will represent the firm in London, Paris, Havana, and Rio de Janeiro; Mitsui & Co., 65 Broadway, New York City, in Japan, China, Philippine Islands, and Honolulu; and Gustav Neilson, A/S, Christiana, Norway, in Norway, Sweden, and Denmark.

**Norton Co.**, Worcester, Mass., has absorbed the Norton Grinding Co., and the latter name will not be used in the future, but the business of both the Norton Co. and the Norton Grinding Co. will be conducted under the name of the Norton Co. The Norton Co. has for some years owned practically all the stock of the Norton Grinding Co., and the directors of both companies have been the same. The board of directors remains unchanged, and the personnel of the two companies has been combined. George I. Alden, president of the Norton Co., is chairman of the board of directors; Charles L. Allen is president and general manager; Aldus C. Higgins, treasurer and general counsel; and George N. Jeppson, secretary and works manager. W. LaCoste Neilson will be vice-president and foreign manager, and Carl F. Dietz vice-president and general sales manager. The reason for the change is that the business of both companies has reached such a volume and spread to such an extent in foreign countries, that there seemed to be many advantages in conducting the grinding machine and the grinding wheel business as a single enterprise.

VOLUME 25 **MACHINERY** NUMBER 12

AUGUST, 1919

THE INDUSTRIAL PRESS, 140-148 LAFAYETTE ST., NEW YORK CITY

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### Principal Articles to Appear in September MACHINERY

AUTOMOBILE FACTORY TRANSPORTATION SYSTEMS..... *Edward K. Hammond*

CUTTING LUBRICANTS FOR MACHINE TOOLS.....*Reginald Trautschold*

PLANNING AND CONTROLLING PRODUCTION.....*Ivan R. DeArmand*

PLACING THE RIGHT MAN IN THE RIGHT JOB.....*W. D. Stearns*

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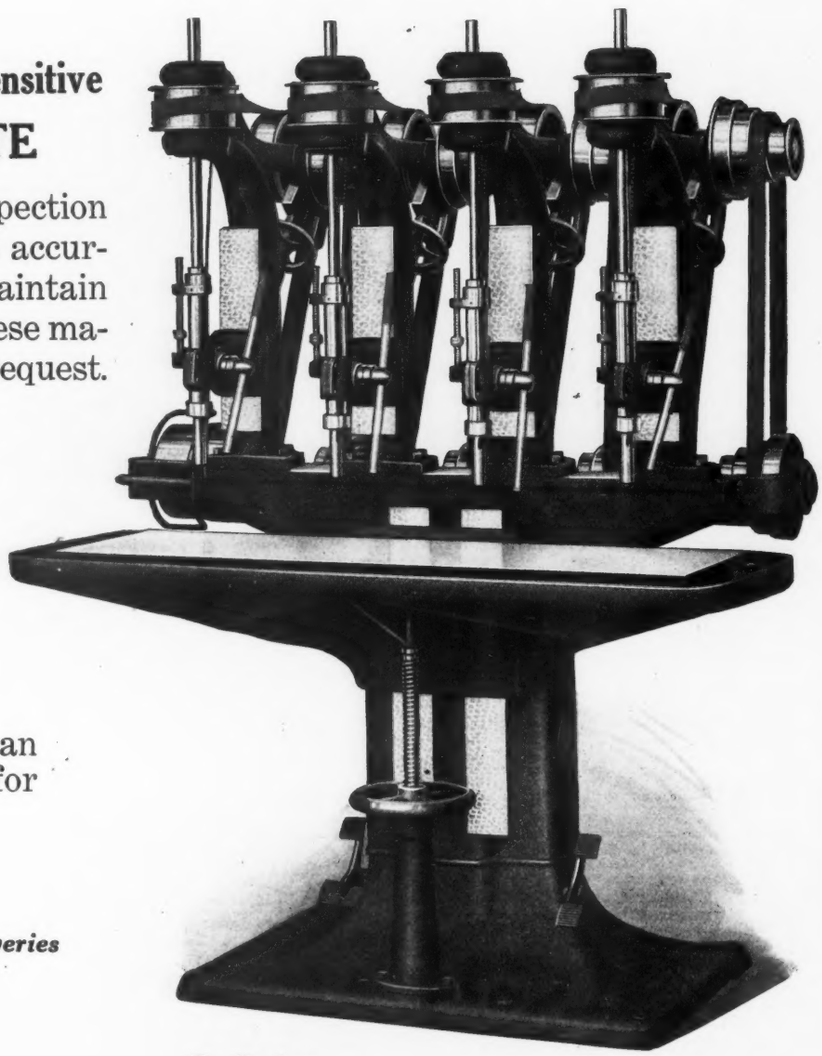
# Leland-Gifford Sensitive Drilling Machines

## *For Large Production*

**Rigid-Powerful-Sensitive**
**ACCURATE**

Our sample inspection sheet showing the accuracy which we maintain on every one of these machines sent on request.



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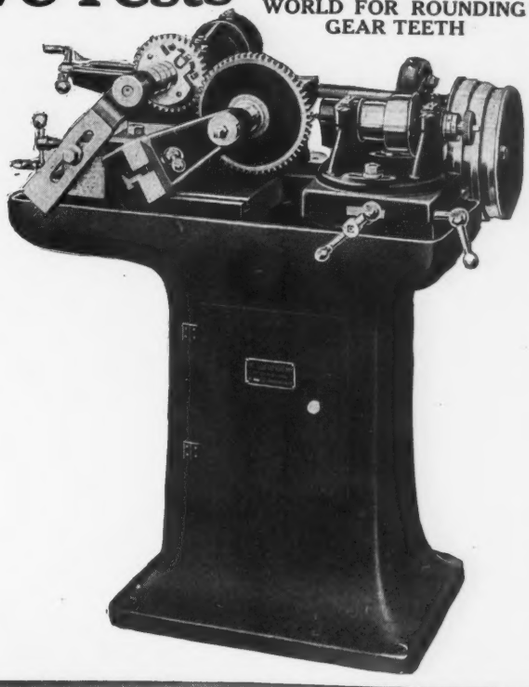
## Best in Competitive Tests

THE STANDARD MACHINE OF THE WORLD FOR ROUNDING GEAR TEETH



They have proven that they round gear teeth 2½ times faster than any other machine. They handle any type gear from 1½" to 30" in diameter.

## If You Manufacture

any kind of sliding gears, such as are used in automobiles, tractors, machine tools, or any other machinery, you need the Rochester Gear Tooth Rounding Machine to help cut costs and increase production.

*We've a booklet that tells all about it. Shall we send it?*

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## One of a Famous Trio

The Genuine Walworth Stillson Wrench, in construction and operation, is ideal. As a unit of the famous Walworth Trio it has an added value. Each of these three wrenches has a distinctive purpose; together they serve all purposes. Put the Walworth Parmelee and the Walco Hex alongside your Walworth Stillson. Shall we send circular?

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**Certified Accurate to the *Millionth* of an Inch**

HOKE PRECISION GAGES are the most accurate gage blocks ever produced, being kept *within five millionths of an inch* of marked size, up to one-half inch, and within ten millionths per inch of length over one-half inch. (This is equal to the expansion caused by the change of one degree Centrigrade in temperature). As the average purchaser cannot check accuracy within such limits, we furnish with each set a Bureau of Standards' certificate giving the errors of each block.

HOKE PRECISION GAGES can be furnished in 81 Block (English) and 103 Block (Metric) sets, or in smaller sets as desired. The smallest set consists of 5 blocks, 1, .5, .3, .2 and .1 in., illustrated above, which gives any tenth of an inch up to 2 in. Blocks can be bought separately if desired.

HOKE PRECISION GAGES have all the desirable features of the imported gage blocks, and more, besides giving literally *double the accuracy at much lower cost.*

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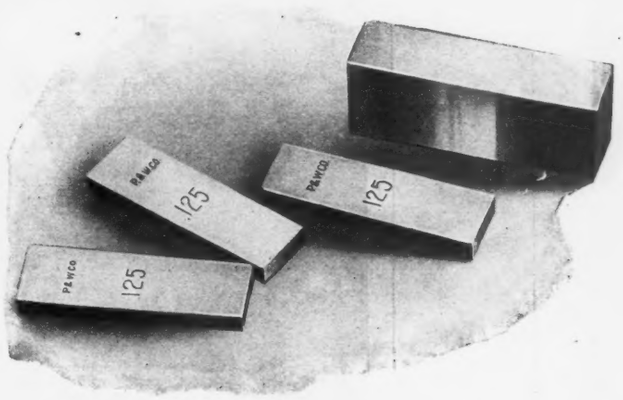
The "Swedish Type" Gages are considerably lower priced than the Hoke Precision Gages. Guaranteed flat, parallel and accurate within .00001" up to one inch in length and within .00001" per inch, over one inch in length. (This is equal to the expansion caused by a change in temperature of one degree C.)

These blocks are similar to and interchangeable with the familiar imported gage blocks, but are of greater accuracy, better finish, flatter and more nearly parallel. They wring together better and last longer. Can be bought singly or in sets as desired.




## "Mikechecks"

These convenient and accurate means of testing the errors in micrometers are sold low enough in price to place them in the hands of every mechanic and tool maker.

Made in .100", .200", .300", .500", 1.00" and 2.00" sizes, also in 2.5, 5, 7.5, 12.5, 25 and 50 millimeter sizes.

They wring together as firmly as the best imported gage blocks and are guaranteed flat, parallel and accurate within .000025" up to one inch in length and within .000025" per inch, over one inch in length.

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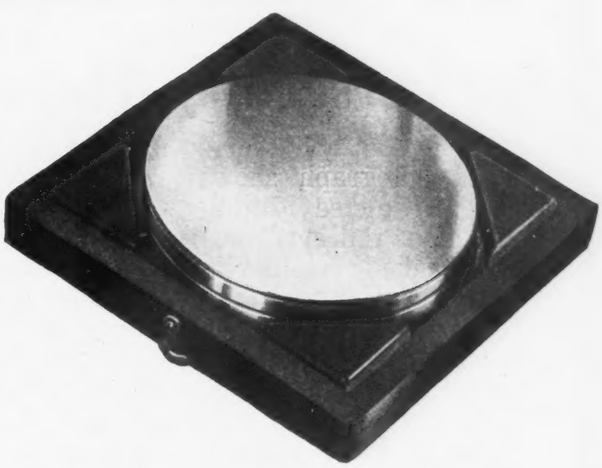
Toolmakers' Flats are surface plates of hardened chrome-alloy steel, lapped with two parallel faces each flat within .00001" and finished so that gage blocks will wring onto them, as they will wring onto each other. See opposite page.

The ordinary scraped cast-iron surface plate that quickly wears out of true and that is at best a succession of hills and valleys is a poor makeshift where accurate inspection and measuring work is required. These P. & W. "Toolmakers' Flats" are accurate to begin with and are of finish and hardness to retain this accuracy. Every tool maker accustomed to fine work will find numerous uses for them. Made in 5" diameter size at present. Other sizes are under production.



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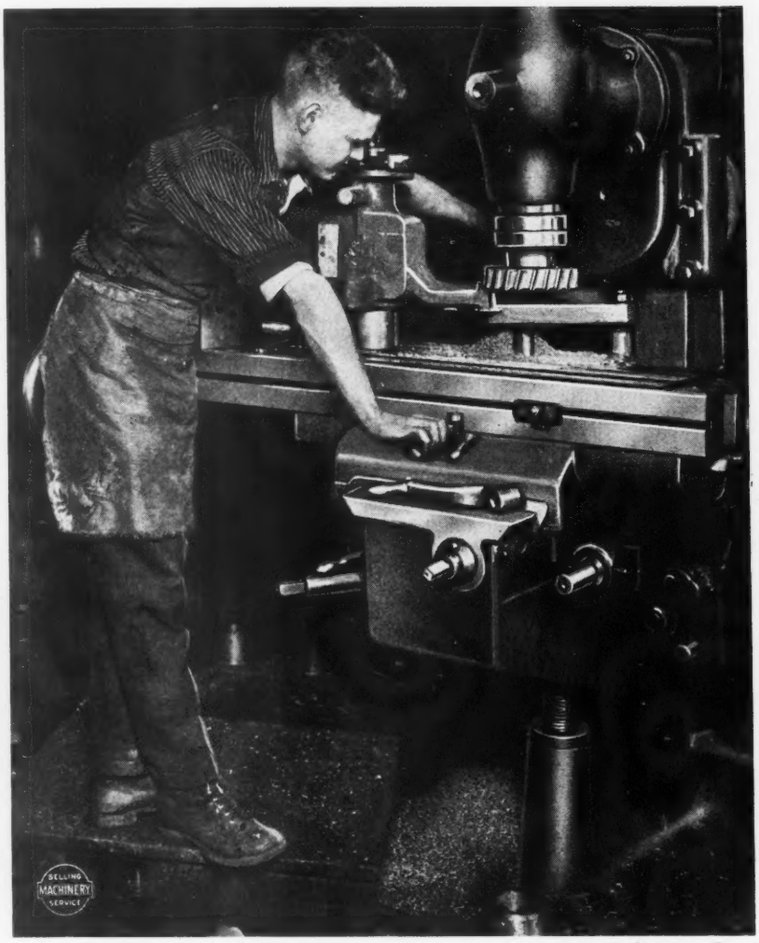
# The Milwaukee Milling Machine



## Its Versatility Makes It Generally Useful

The photograph shows the Milwaukee Milling Machine milling pads for brake arms on a spring carrier for a 2½-ton truck rear axle. The machine is of the horizontal type and is fitted with vertical attachment. The Empire Axle Company of Dunkirk, N. Y., finds that the "Milwaukee" is not only readily adaptable but also capable of performing fast and well in this position. The "Milwaukee" has been used for a wide range of work in this plant and has met every requirement. Its extreme rigidity and accuracy of aiignment make it particularly valuable in handling heavy work of a particular nature. Double overarm—flanged spindle, reverse for which is self-contained in the machine—solid top, box section knee—automatic flooded lubrication—cutter lubricating system an integral part of the machine—all combine to increase production, improve quality of output, lower upkeep and add to ease of operation. Send for Catalog No. 20.

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# QUALITY

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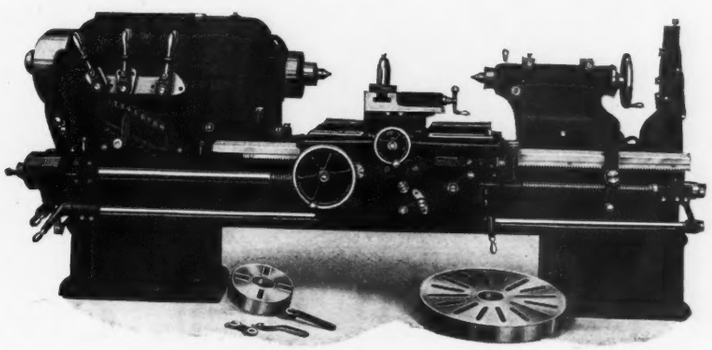
Uniform and permanent alignment.
Carriage has six bearings on bed.
No overhang of Compound Rest Base.
Double Walled Apron.
Steel Quick Change Gears.

***For complete information on* LODGE & SHIPLEY *Lathes write for catalogue***

## THE LODGE & SHIPLEY MACHINE TOOL CO.

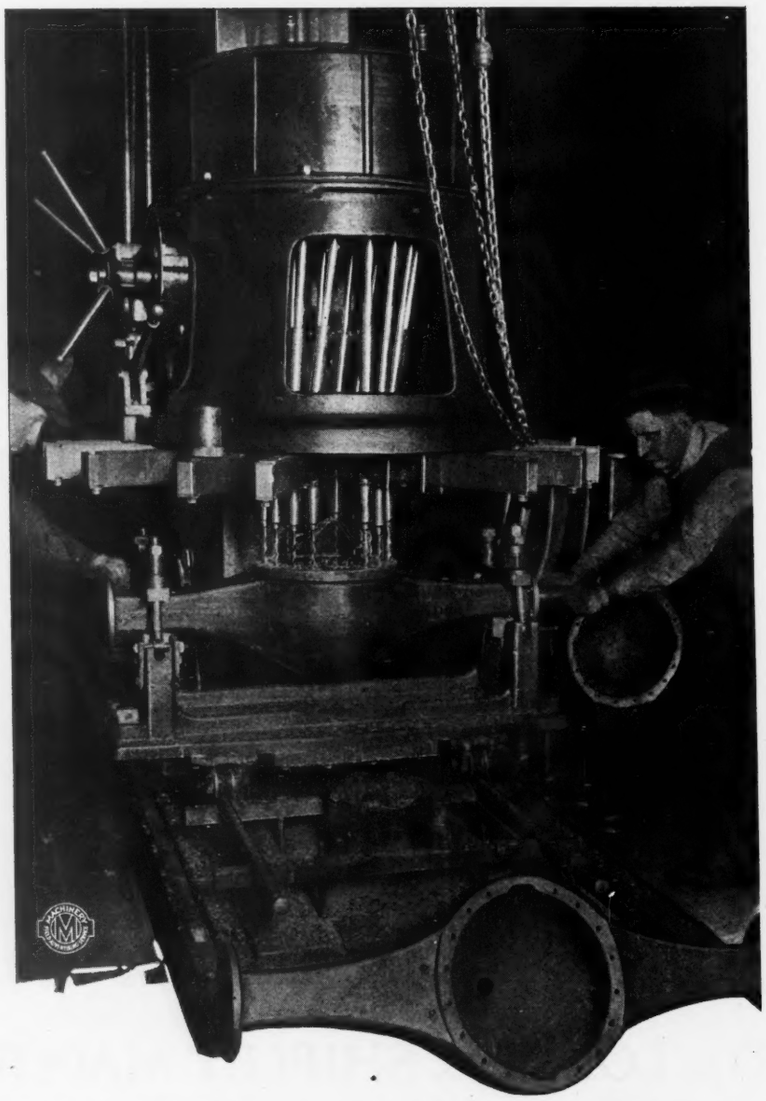
CINCINNATI OHIO, U. S. A.



**"Lathes—Good Lathes Only"**

# Baush Multiple Spindle Drill

## Where Accuracy and Speed are Essential



Upward, ever upward, runs the peak load of the automobile manufacturer. Standardization makes bulk production possible—standardization means the utmost in accuracy.

That the Timken-Detroit Axle Co. found the correct method of combining quality and quantity is well illustrated by the photograph. This No. 4 Baush Multiple Spindle Drill is in *constant operation* in this well-known Detroit plant.

The job shown requires 16 spindles, each one fitted with a drill 27/64" diameter. The parts being drilled are rear axle housings for commercial cars. Housings are made of formed steel, and a reinforcing ring is welded inside, making the total thickness of metal drilled ½". Drilling time is 60 seconds.

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## *Turning Paper-Like Thicknesses*

***We'll send complete details upon request***

AN important part of the Olsen Hardness Testing Instrument is a carefully finished bronze piston 6″ in diameter.

The piston head is hollowed out to a considerable depth, the recess curving toward the periphery, and terminating in a wall that has been turned to paper-like thinness. You may take this literally, for the thickness of the wall does not exceed 0.005″. Even with the special fixtures used, a lathe of the highest quality is essential. The Bradford fills the bill. It has made these pistons from the start.

There are other "Bradfords" in this plant, in the tool room and on other manufacturing operations. On heavy and light cutting, the same standard prevails.

## BRADFORD MACHINE TOOL COMPANY

**CINCINNATI** **OHIO, U. S. A.**

AGENTS: Swind Machinery Co., Philadelphia. Taylor Machinery Co., Boston, Mass. Stocker-Rumely-Wachs Co., Chicago, Ill. Somers, Fitler & Todd Co., Pittsburgh, Pa. The E. A. Kinsey Co., Cincinnati, O., and Indianapolis, Ind. The Mine & Smelter Supply Co., Denver, Colorado. Pacific Tool & Supply Co., San Francisco, Cal.

These parts are made in the plant of the Tinius Olsen Co., of Philadelphia, on a Bradford Lathe.

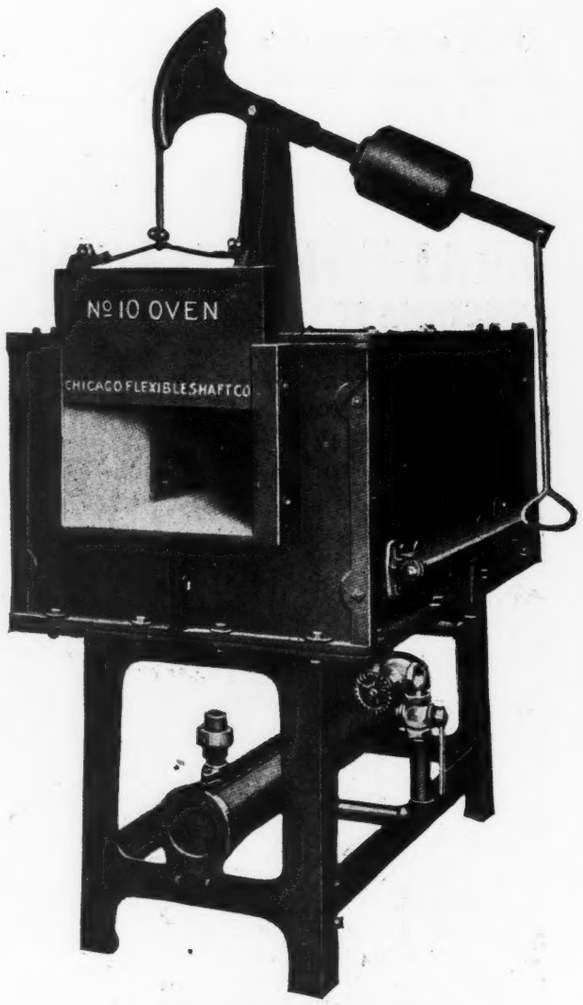
# *Heat-Control of*
# Stewart Oven-Furnaces

War-taught lessons in scientific metallurgy abolished the "rule-of-thumb" —once for all.

The pyrometer, not the "wizardy" of the self-satisfied color-expert, is now in charge.

*This new order-of-things calls for heat treating, annealing and carbonizing furnaces that permit of*

## Accurate Control of Temperatures




And Stewart Indirect-Heat Furnaces are equal to the most rigid requirements in this direction.

This control is partly a matter of scientific and accurate mixing of gas and air before it is admitted to the combustion chamber.

Partly due to the placing, spacing and direction of the non-carbonizing burners used on all Stewart Furnaces.

Partly to the scientific relationship of chamber-area to port hole areas.

Partly to the shape and position of hearth.

Partly to the fact that the quality and thickness of our linings and the sturdy strength of our frames and casings all contribute to the permanent *tightness* of Stewart Furnaces.

All these, and many other features—in combination—place Stewart Furnaces in a class by themselves; recognized for their accuracy, dependability, and great endurance.

***Send for our New Catalog and get the whole story***

## CHICAGO FLEXIBLE SHAFT CO.

**1154 SO. CENTRAL AVE. CHICAGO, ILLINOIS**

# *A Difficult Problem—Solved With A*
# LANDIS THREADING MACHINE

This material, as the man in the shop would say, "is funny stuff." It is quite hard, yet so tough that a lot of hammering only bends it a little. Given enough power and one of these pieces can be tied in a knot, yet it won't break. This is the stuff that is put into airplanes.

Imagine trying to thread it on a quantity-quality basis. The superintendent here tried it without success, until the Landis Threading Machine arrived. That was nearly a year ago, and now all's changed; the work proceeds without a hitch. There are 24 threads per inch, diameter is 5/16", and length of thread 5/8". Approximately 3,000 pieces are turned out each 8 hour shift.

*Get the Catalog*

## LANDIS MACHINE COMPANY, Inc.

WAYNESBORO PENNSYLVANIA

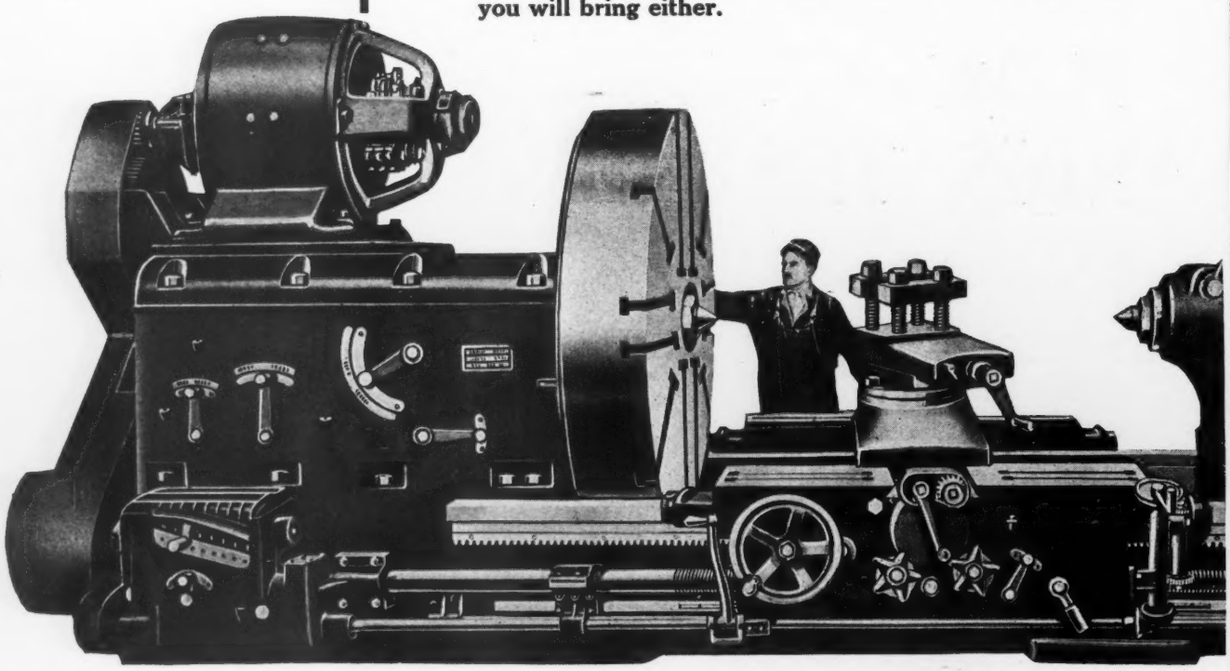
BRIDGEFORD

# *You Can Rely on BRIDGEFORD Lathes*

**Pace setters for twenty years in the heavy duty lathe field, BRIDGEFORDS can be depended upon absolutely. It would be like painting the lily for us to use the word "best" in connection with BRIDGEFORDS, but we *are* prepared to show you how you can increase production with BRIDGEFORDS.**

**Baldwin and American, in the locomotive field—New York Central, Pennsylvania, Southern Pacific, Santa Fe, in the railroad field—Cambria, Standard Steel Car, Bethlehem Steel, Standard Oil, International Harvester —all of these names are on our customer list. They are only a few of the prominent ones, though.**

**Let us send you a list of installations near you. A Catalog? A Salesman? Specifications? A word from you will bring either.**



**Makers of Heavy Duty Machine Tools Since 1861**

**BRIDGEFORD MACHINE TOOL WORKS**

**151 Winton Road Rochester, N. Y.**

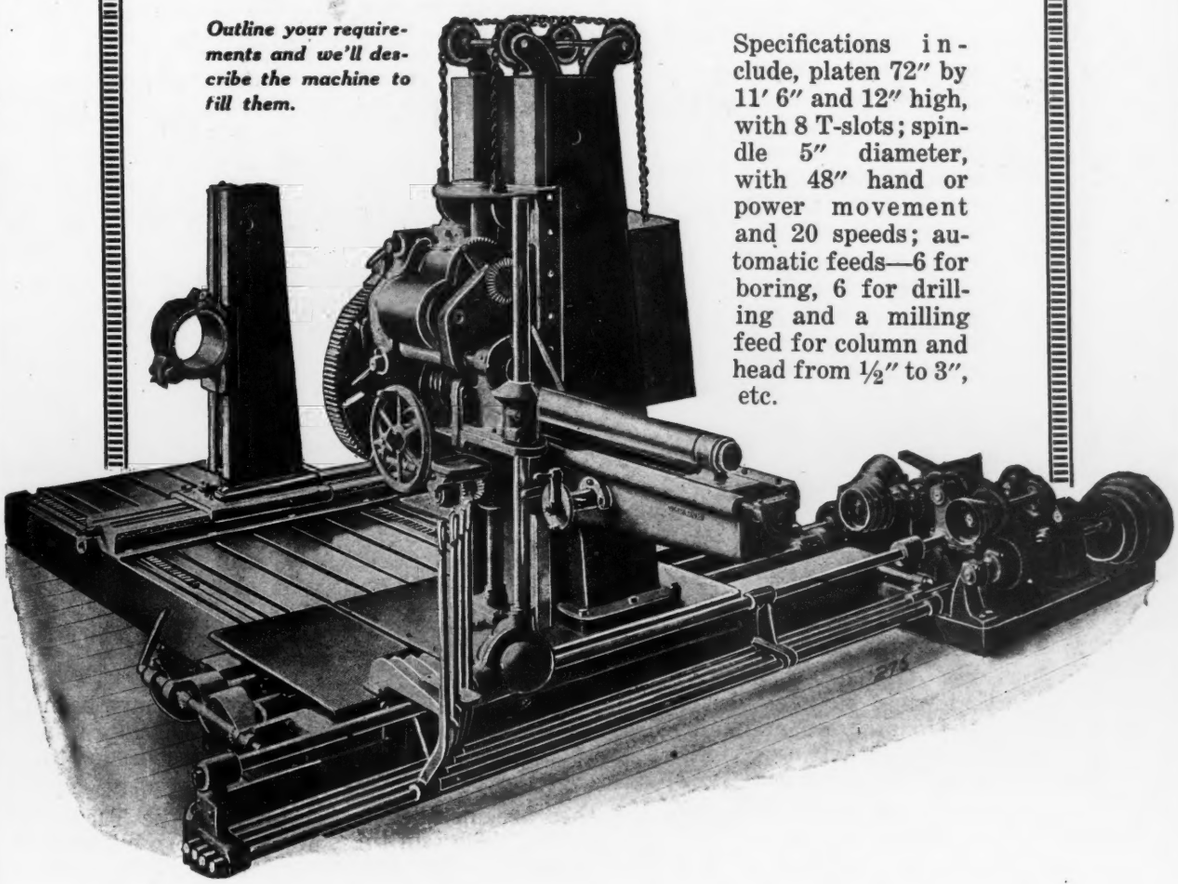
B.&S.

# Practical Production Machines

Beaman & Smith machines are designed for rapid production. They all have wide range. Each is specially adapted to handle some particular class of work to best possible advantage. This Horizontal Drilling, Boring, Tapping and Milling Machine is built especially for drilling and tapping long work and for boring cylinders, crank cases, shaft holes in box beds and similar large cumbersome parts which must be commercially accurate.

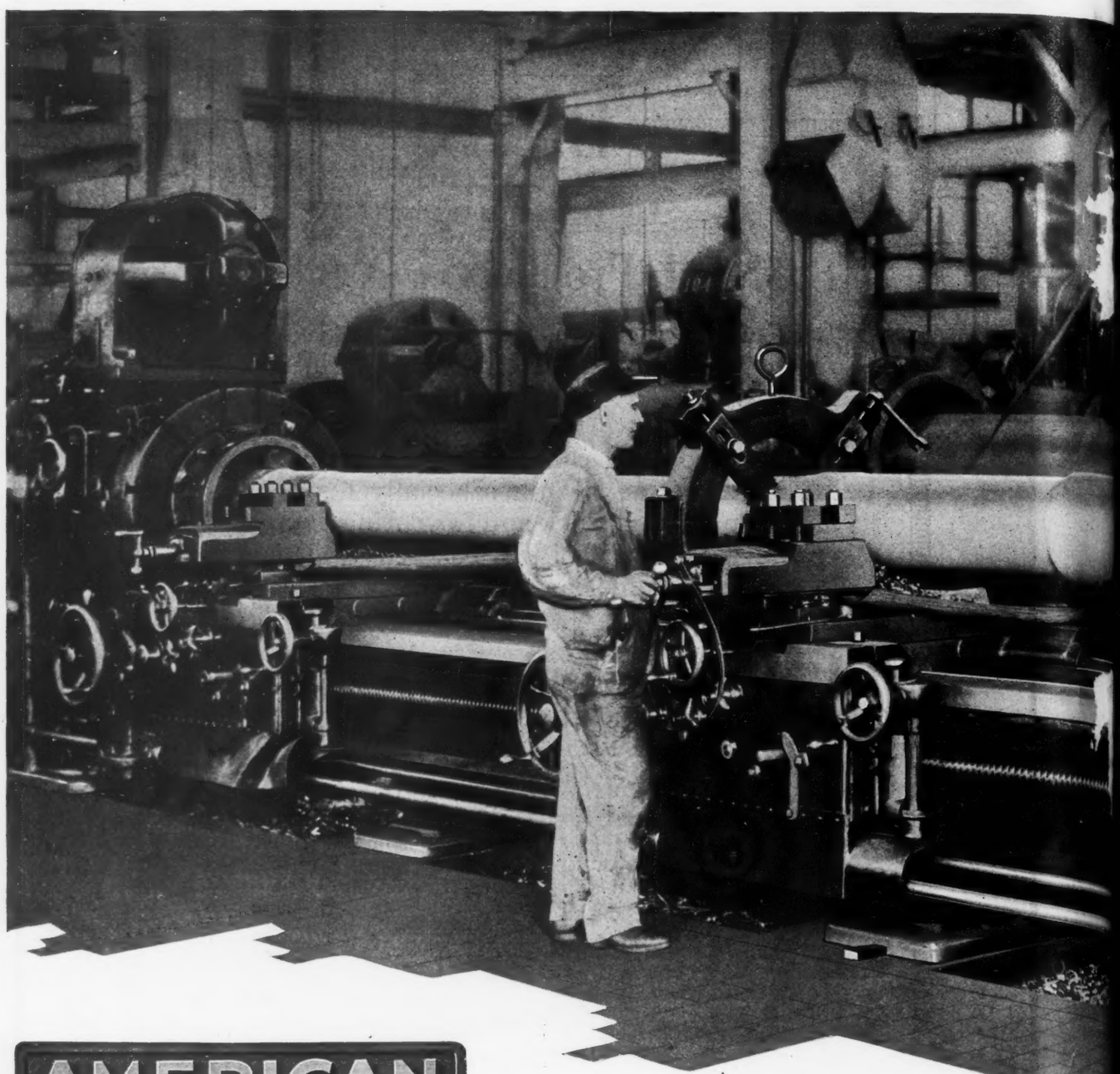
*Outline your requirements and we'll describe the machine to fill them.*

Specifications include, platen 72″ by 11′ 6″ and 12″ high, with 8 T-slots; spindle 5″ diameter, with 48″ hand or power movement and 20 speeds; automatic feeds—6 for boring, 6 for drilling and a milling feed for column and head from ½″ to 3″, etc.



## BEAMAN & SMITH COMPANY

**PROVIDENCE** **RHODE ISLAND**



AMERICAN

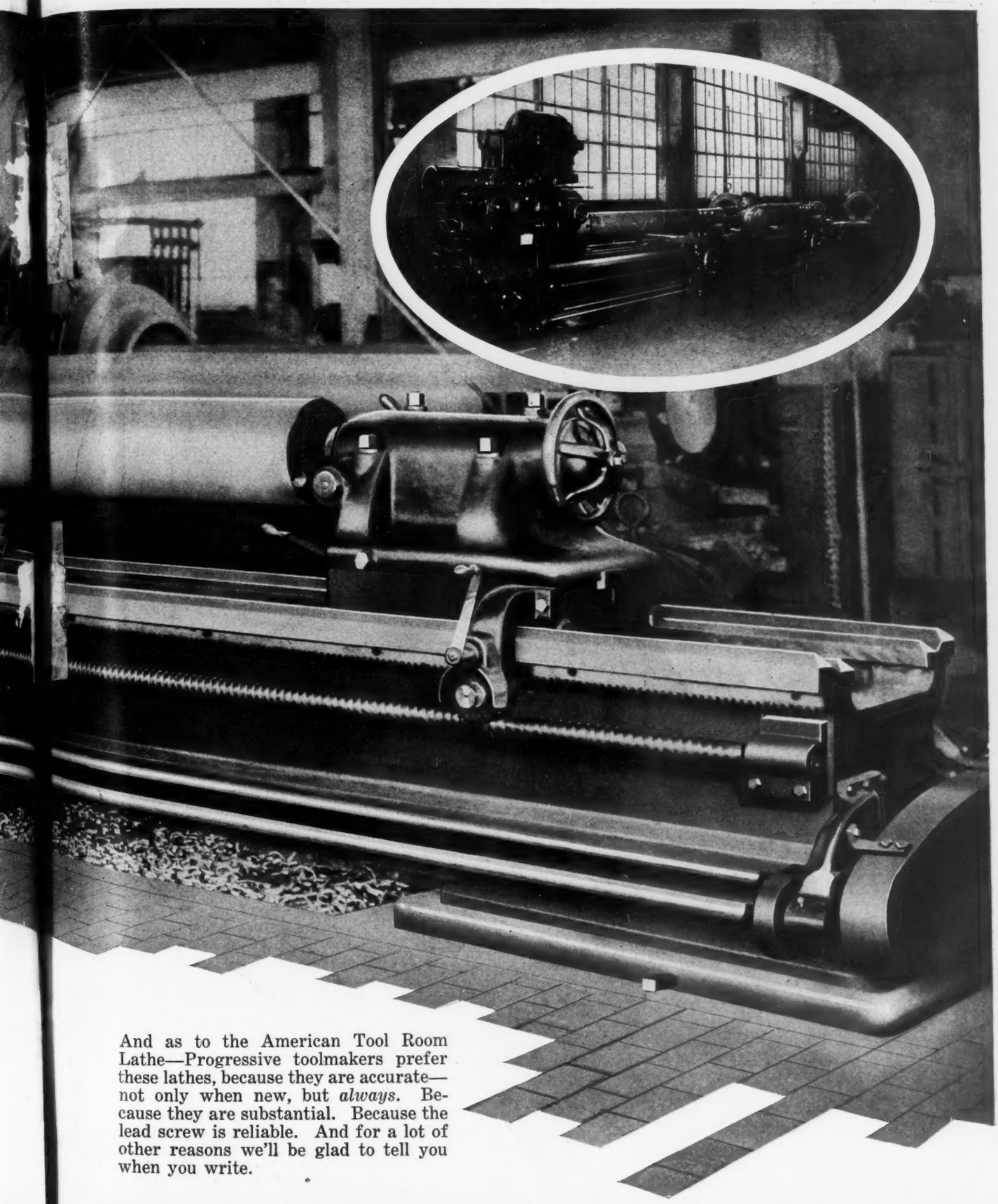
# Turn This, It Will Turn Anything!

A lathe that will turn gun tubes will turn anything. Gun tube turning may have been no different from any other turning, but the stock was mighty tough steel, and there was no time to waste in cutting it. These two factors combined gave a lathe all it needed to "test its metal."

These busy 36″ geared head American Lathes are installed in the plant of the Tacony Ordnance Corporation, Tacony, Philadelphia, Pa. The gun tubes were for 75 millimeter guns. The cut is ⅜-inch deep, the surface speed 30 feet per minute, the feed ⅛ inch. That's removing some metal, isn't it?

## THE AMERICAN TOOL WOR

LATHES PLANERS



And as to the American Tool Room Lathe—Progressive toolmakers prefer these lathes, because they are accurate—not only when new, but *always*. Because they are substantial. Because the lead screw is reliable. And for a lot of other reasons we'll be glad to tell you when you write.

# KS COMPANY, Cincinnati, Ohio

**SHAPERS RADIALS**

**This booklet shows Fay Automatic methods and tooling on various type of pulleys. The data is highly valuable as a basis from which to make comparisons, figure costs, etc. Be sure to send for your copy.**

THIS is the first of a series of pamphlets recording modern machine shop practice. Each number will be confined to the treatment of a single class of parts. It is the aim to discuss the problem of machining these parts from the standpoint of the designer and of the shop owner, as well as from that of the production man.

In all the cases selected, the work has become standardized in the general features of its design. This permits in turn a standardization of manufacturing methods. It is believed that the methods described represent truly advanced practice. They are presented, in fact, as being worthy of adoption as standard practice for the work in question.

A copy of this pamphlet will be sent on request to any one interested, whether apprentice boy or manager. If you will give your position, and the name of the firm you are connected with we will appreciate the courtesy.

# JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

109 QUEEN VICTORIA ST., LONDON, E. C.

For France, Spain and Belgium : F. Auberty & Co., 91 Rue de Maubeuge, Paris. For Holland: Spliethoff, Beeuwkes & Co., Rotterdam. For Sweden: A. B. Galco, Ltd., Stockholm. For Australasia: McPherson's Pty., Ltd., Melbourne. For Japan, Manchuria, Korea and Formosa: Mitsui & Co., Tokyo.

## COUPON

*Please put me on your mailing list for the series of pamphlets you are preparing on modern machine shop practice.*

Name .....

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Address .....

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City .....State.....

My position is.....

With .....

# "Cost a Little More— Worth a Whole Lot More."

# BETTS

Planers

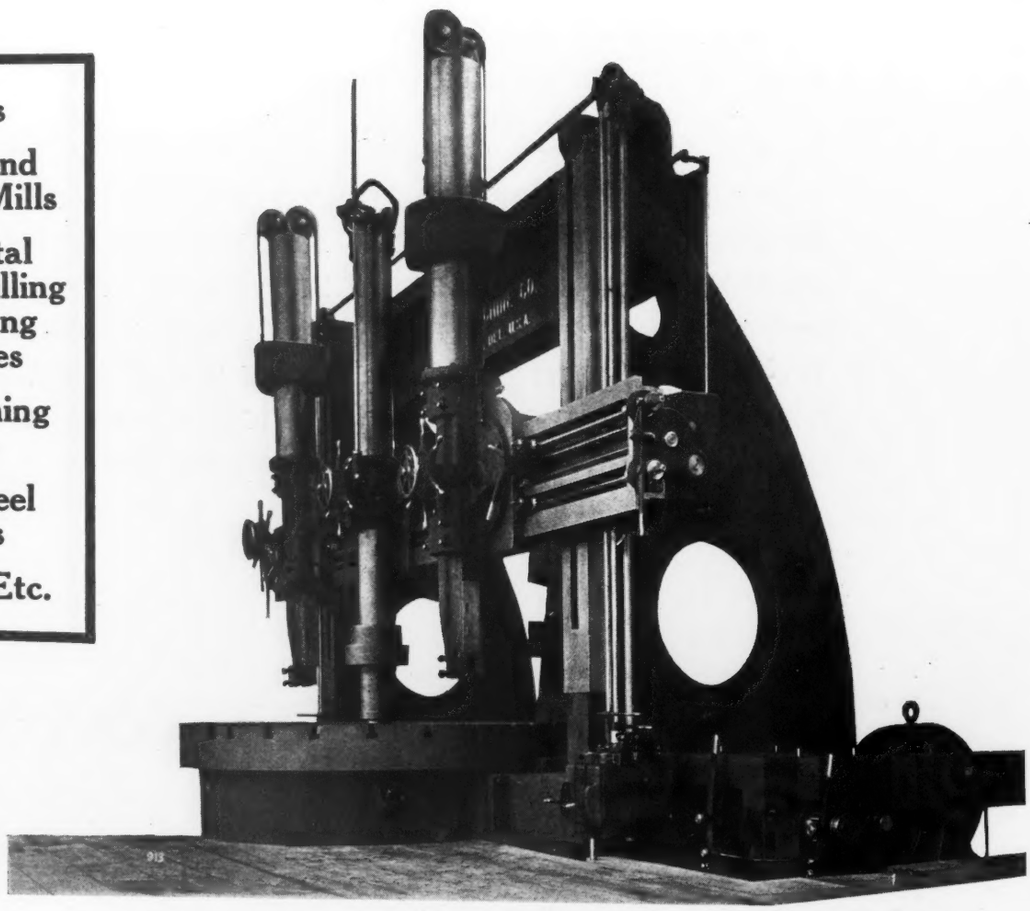
Boring and Turning Mills

Horizontal Boring, Drilling and Milling Machines

Tire Turning Mills

Car Wheel Borers

Slotters, Etc.



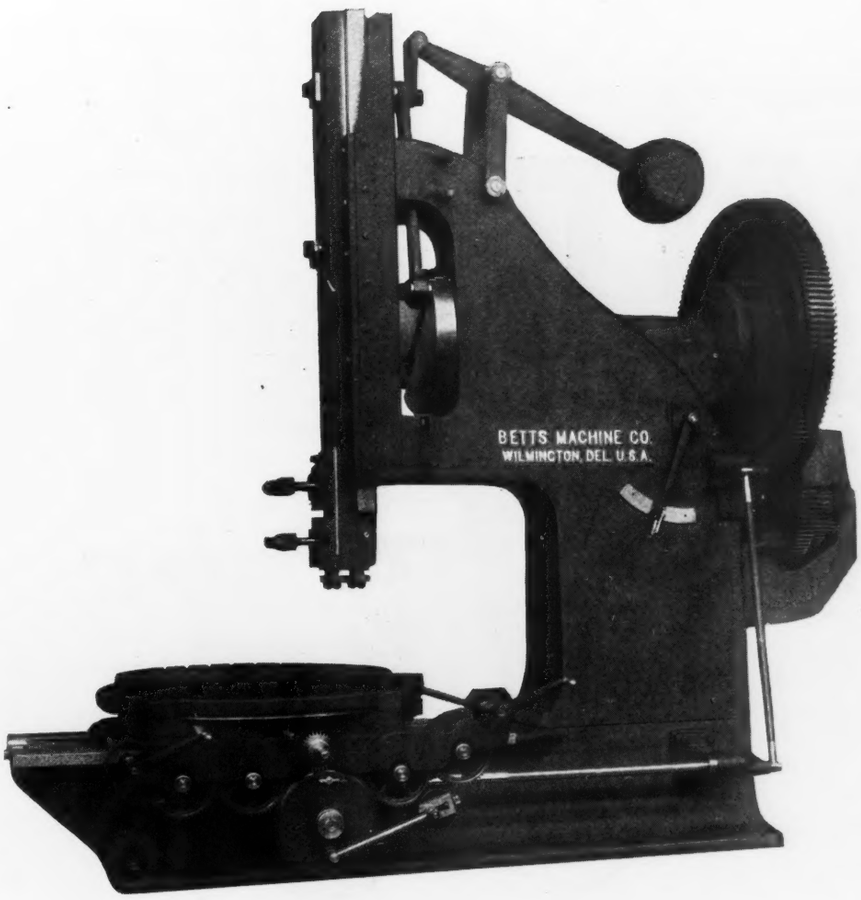
## BETTS MACHINE CO.

400 Blossom Road Rochester, N. Y.

HEAVY BETTS DUTY

"Built for Service—
Not to Sell at a Price."

# BETTS




Planers

Boring and Turning Mills

Horizontal Boring, Drilling and Milling Machines

Tire Turning Mills

Car Wheel Borers

Slotters, Etc.

## BETTS MACHINE CO.

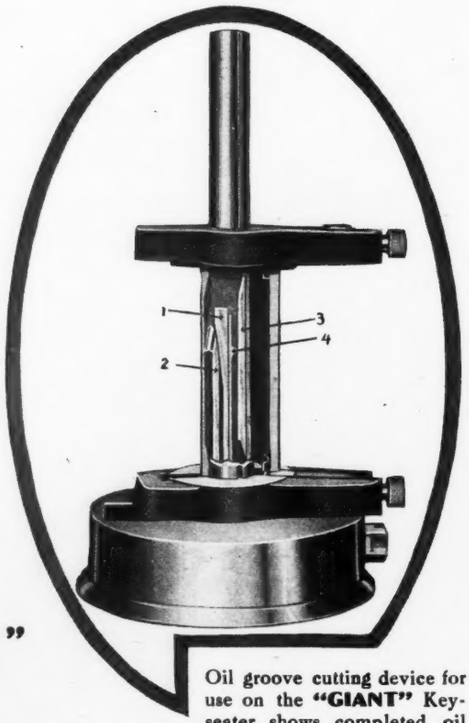
400 Blossom Road Rochester, N. Y.

HEAVY BETTS DUTY

# If Your Problem is One in a Million—

We are guessing when we try to state just how many problems **"GIANT"** Keyseaters *have* solved. This we do know, however, and so will you, if you've been following our advertisements: **"GIANT"** Keyseaters have extraordinary durability. Instances of service for 15 and 20 years are common. They have great adaptability. Thus, the number of problems **"GIANT"** Keyseaters have worked out must be tremendous.

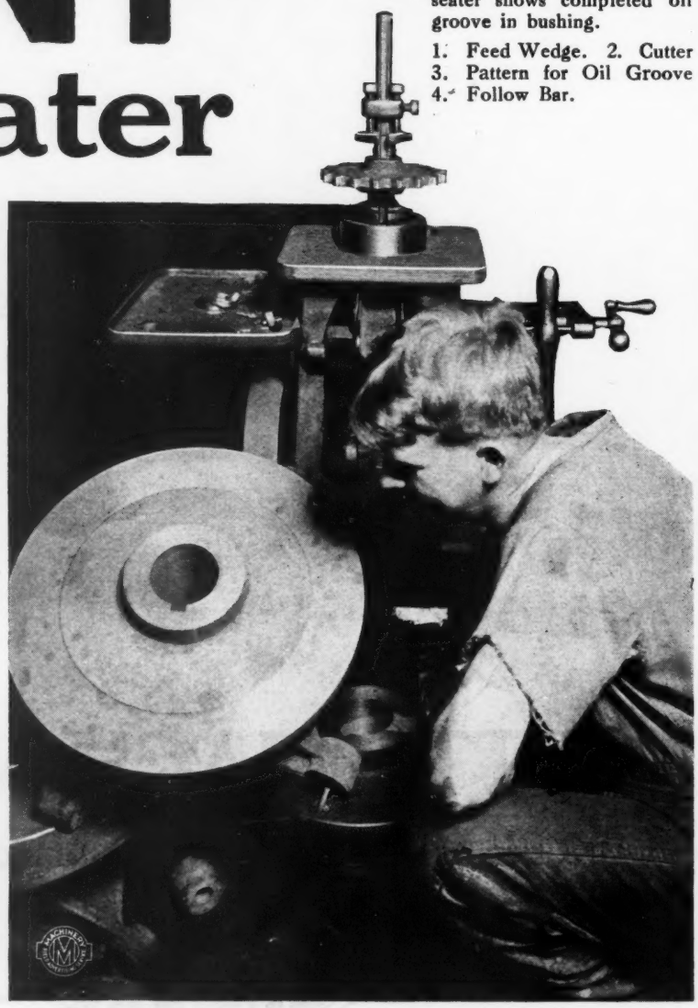
Your problem is probably one that the **"GIANT"** has already had. If you'll give us the details, we'll be glad to tell you exactly what you may expect from a **"GIANT"** Keyseater.




Oil groove cutting device for use on the **"GIANT"** Keyseater shows completed oil groove in bushing.

1. Feed Wedge. 2. Cutter 3. Pattern for Oil Groove 4. Follow Bar.

# "GIANT" Keyseater



This photograph was taken in the Toledo plant of Kerscher Bros., and shows a heavy elevator gear center, in the bore of which the **"GIANT"** has cut a 3/4" standard keyway 10" long. Time was three minutes.

The small sprocket on the **"GIANT"** is set up for the cutting of a 1/4" keyway 2" long. These sprockets are handled on a production basis at the rate of 120 per hour.

***Complete description in catalog***

## MITTS & MERRILL

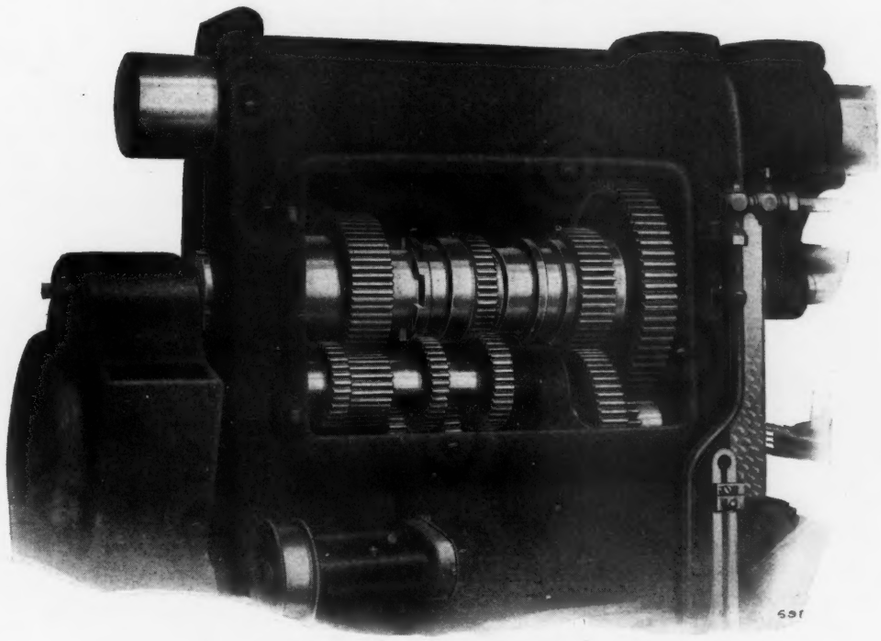
**843 Water Street**

**SAGINAW MICHIGAN**

**FOREIGN AGENTS: Burton, Griffiths & Co., Ltd., London, England. Leon Chapin, Paris, France.**

# Chrome Nickel Steel Driving Gears

## *A Positive Production Factor*



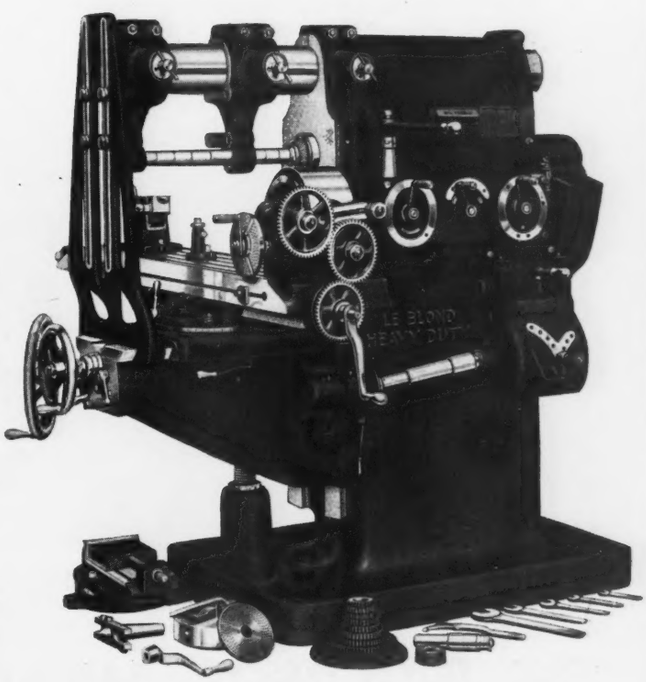
**Note the Extra Large Face Gear, as Large as the Largest Cutter the Machine will Swing.**

THE sliding gears and clutches are made of Chrome Nickel steel, heat treated and hardened. The teeth are of stub form to increase their strength and the ends rounded to permit of easy sliding engagement without clash.

The face gear is as large as the largest cutter the machines will swing on each respective size and all speeds are transmitted through this large face gear as it is the only member keyed to the spindle.

The back gear shaft does not span the full width of column as is common practice but is carried on a short rigid shaft carried in bearings directly under the face gear.

***This is only one of the reasons why LeBlond Heavy Duty Milling Machines are consistently reducing milling costs***

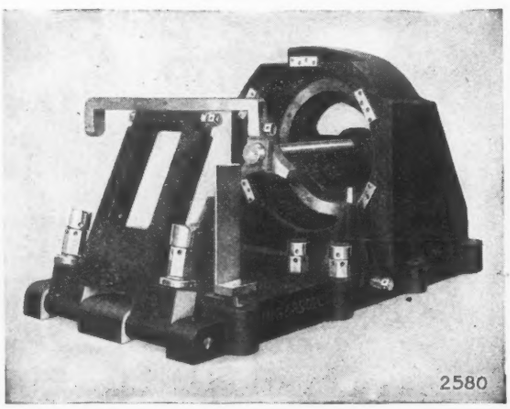


## THE R. K. LEBLOND MACHINE TOOL CO.

**CINCINNATI, OHIO**

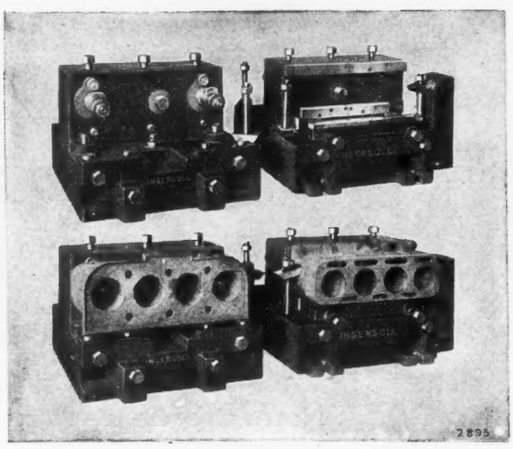
# Ingersoll Milling Fixtures

Because the design of Milling Fixtures is so vital to production that is obtainable from the proper milling machines and cutters, we have for many years placed the information that we have on milling fixtures in the hands of our customers through our Fixture Department. This department is engaged solely in designing and producing milling fixtures.

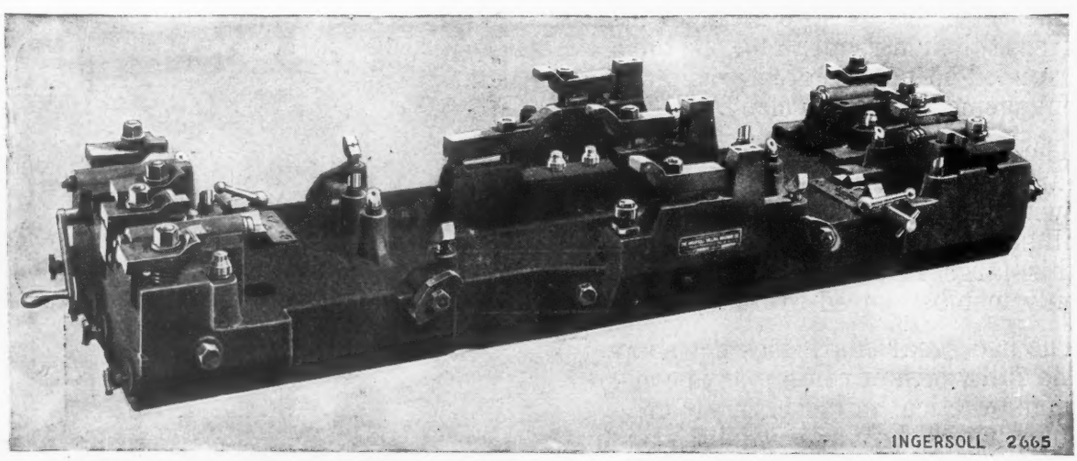



The first and second operations on a naval gun mount were done while the piece was held in this fixture. The piece was a steel casting about 25 inches in diameter and the machining was held to very close limits.

Ingersoll fixtures and special tools are not the embodiment of a single tool engineer's ideas nor are they solely the ideas of our organization, but rather, are designed through the use of a great common fund of information which has accumulated with us through close application to the problem and constant consultation with our customers over their milling operations. This fund of information might truthfully be called a pool of the ideas on milling fixture practice that has developed with the advance of milling operations in this country. It has been added to and proven by the experiences of hundreds of shops and is available for your use. You can be confident that Ingersoll Milling Fixtures represent principles that have proven themselves in actual work and that they can be depended upon for accuracy, convenience, and durability. They carry the same guarantee of performance that every Ingersoll Tool does.




The two figures on the left show the right hand side of the fixtures which held two "Knight" Type motor cylinders during the first operation and the two on the right show opposite side of the same fixtures, which held the cylinders during the second operation. Both operations were accomplished at a single pass of the table.




There were ten seperate milling operations on a field gun recoil cradle done on Ingersoll Milling Machines. Fixtures, cutters, and machine were all designed by us especially for this job. The fixture shown here held the recoil cradle while the ninth milling operation was being performed on an Ingersoll Milling Machine.

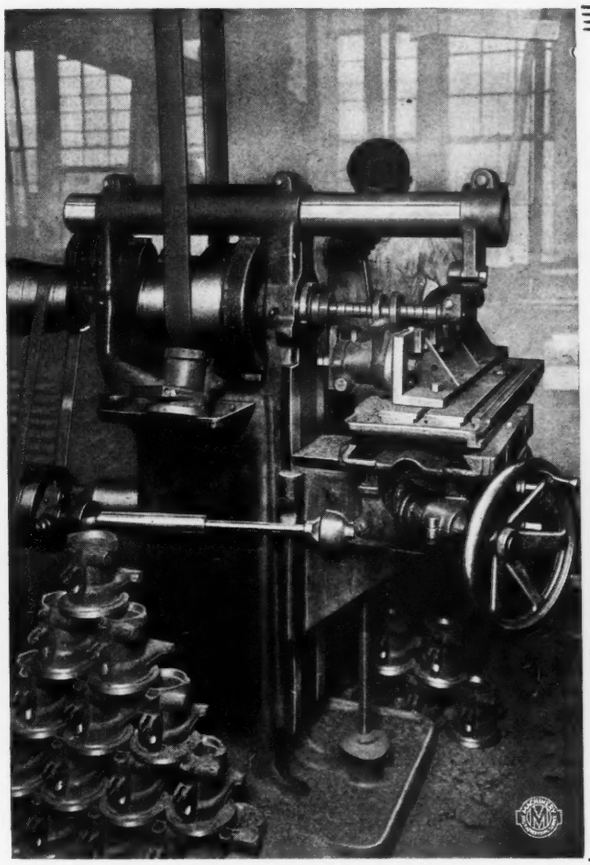
## THE INGERSOLL MILLING MACHINE CO.

*MILLING MACHINES AND THEIR EQUIPMENT*

New York Office, 50 Church St.
The Walter H. Foster Co.,
Managers.

**Main Office and Works:**
**ROCKFORD, ILL., U. S. A.**

Detroit Office,
1457 David Whitney Bldg.
H. C. Rose, Manager.



# Bought at the Time of the Spanish War this KEMPSMITH is Still In Service

NOT many men have served in two wars, and fewer machines—but this Kempsmith is the exception. Still doing first-class work too—or it wouldn't be permitted a place in the plant of the Victor Tool Co., at Waynesboro, Pa. This company has a reputation to maintain; and reputations these days, depend to a large extent upon equipment.

The operation is milling cast iron hubs for patternmakers' vises. Five of these castings are machined on a fixture. Three cutters in a gang are used to mill the sides and top of one lug on each of the castings. About ¼″ of stock is removed, the cut on each side being approximately ½″ wide x 6″ long, and the cut on top of the same length, and approximately ⅞″ wide.

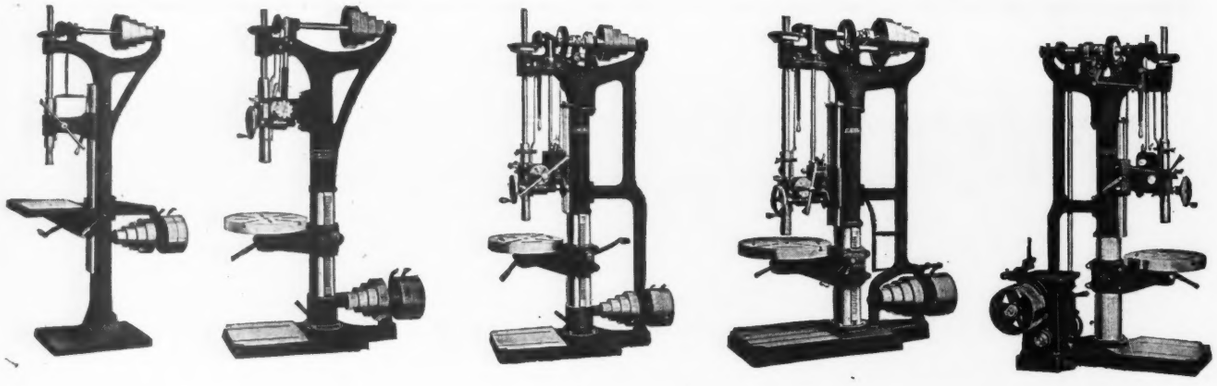
It takes just under thirty minutes to run across the five castings, and one boy has no difficulty in tending this and several other machines.

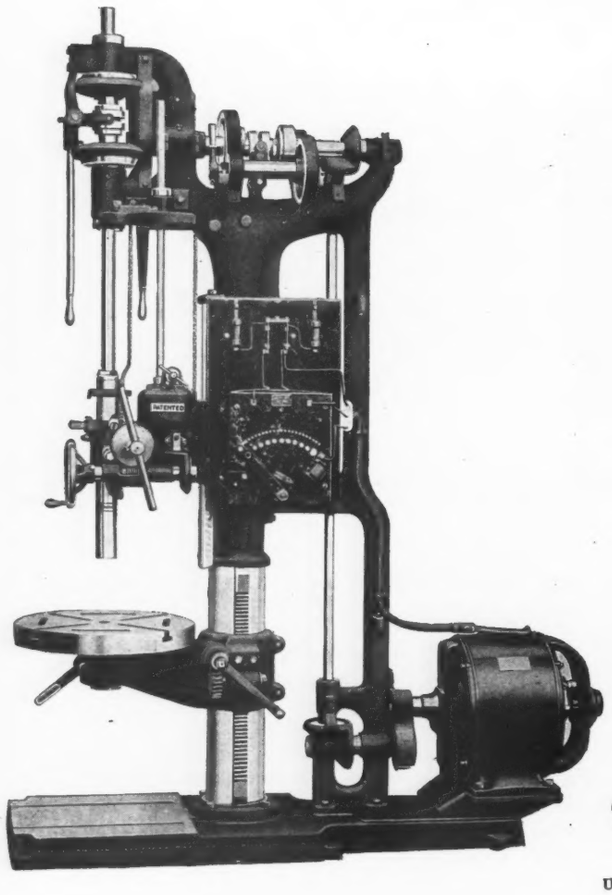
We no longer make the Kempsmith Miller of 20 years ago—many refinements have been instituted since then—but the fact that these old machines still give good service shows what may be expected of those we are making today.

Kempsmith Millers are in the best places everywhere. There's a Kempsmith close to you. Find out where, and see it. Write.

**KEMPSMITH MILWAUKEE, U. S. A.**

FOREIGN DEALERS: Barandiaran & Co., 3 Alameda, San Sebastian, Spain. Edgar Bloxham, 12 Rue du Delta, Paris, France. D. Drury & Co., 1-2 Central House, Main St., Johannesburg, S. Africa. American Trading Co., Tokyo, Japan. Nielsen & Winthers, Copenhagen, Denmark. Parke & Lacy Co., Ltd., 60 Clarence St., Sydney, N. S. W. Australia. Selson Engr. Co., 85 Queen Victoria St., London, E. C. England and 19 Via Botero, Turin, Italy. Spliethoff Beeuwkes & Co., Leuvenhaven, W. Z. 159 Rotterdam, Holland.





THE CINCINNATI

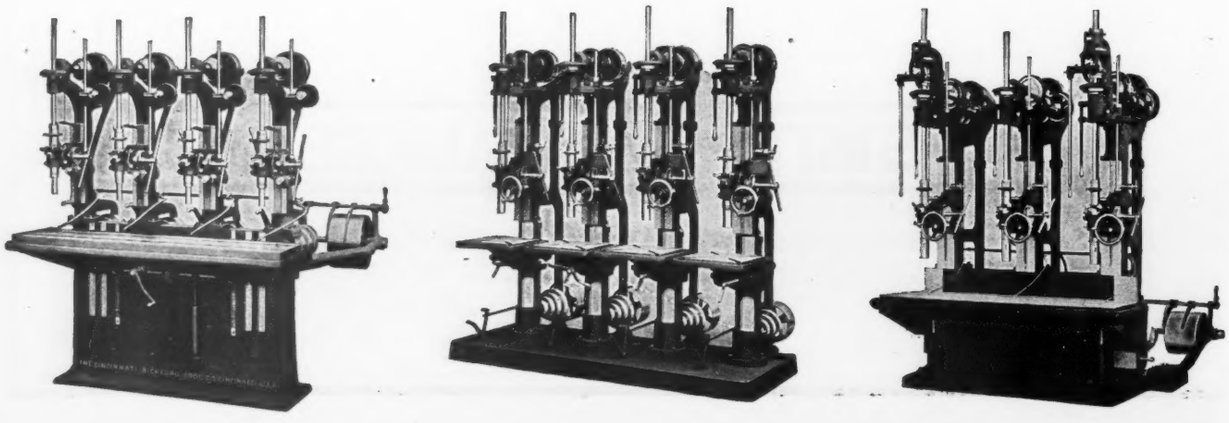
## 24-in. to 42-in. High-Speed Upright Drilling Machine

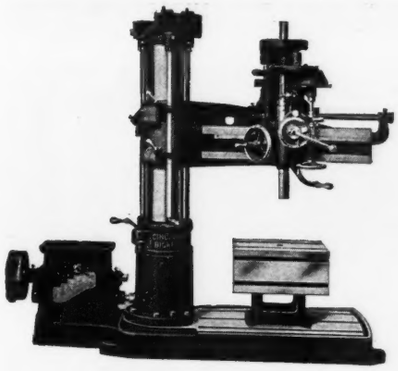
A company which has devoted forty-five years to the designing and building of drilling machines alone must have gained a thorough knowledge of the essentials involved.

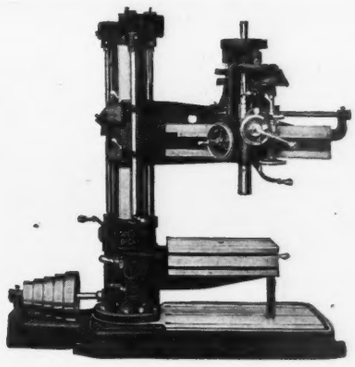
This is the history of our company—specialists on drilling machinery which has set the standard of the world.

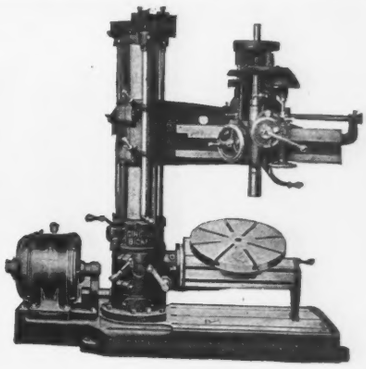
**The Cincinnati Bickford Tool Co.**
**Oakley, Cincinnati, Ohio, U. S. A.**
**Founded 1874**

U558





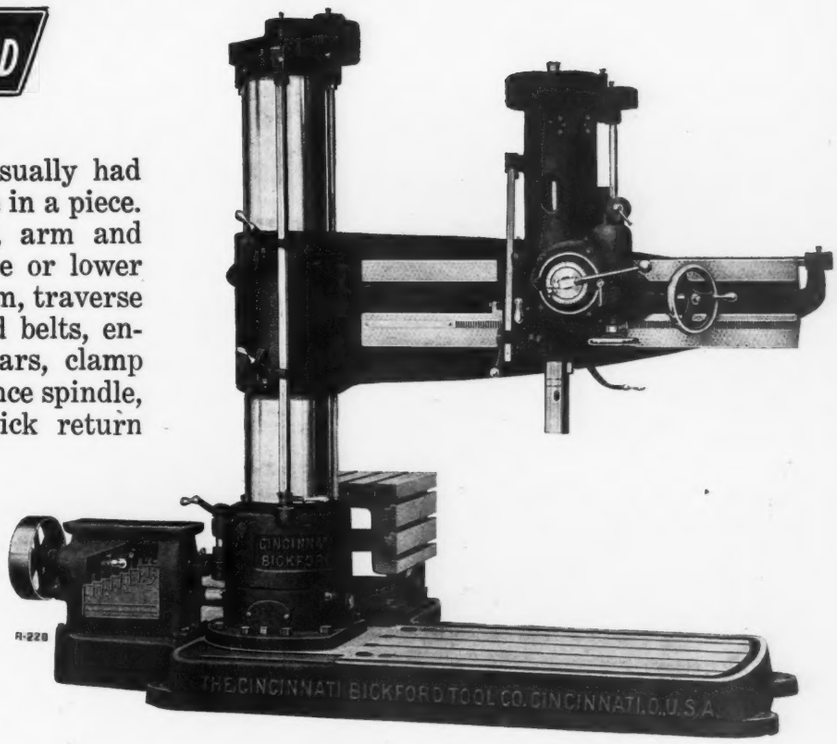




THE CINCINNATI BICKFORD

This is what a workman usually had to do in drilling the first hole in a piece. Insert drill, unclamp head, arm and column, start machine, raise or lower arm, advance drill, swing arm, traverse head, shift driving and feed belts, engage or disengage back gears, clamp column, arm and head, advance spindle, engage feed clutch and quick return lever, drill hole, withdraw drill, stop machine and remove drill.

We have invented means for eliminating 4 of these operations and of saving time on 15 others.

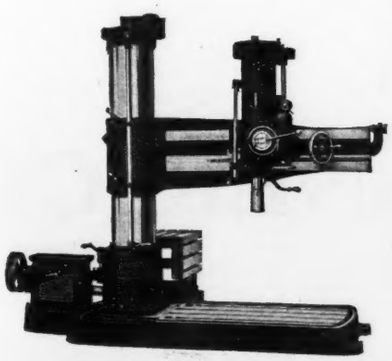


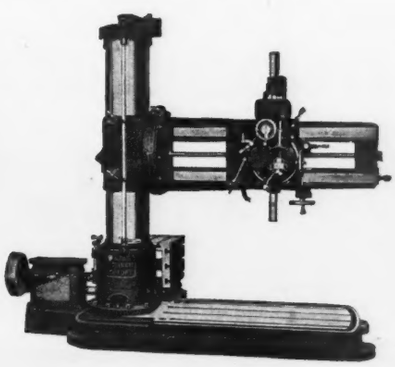

# The Cincinnati Bickford Tool Co.

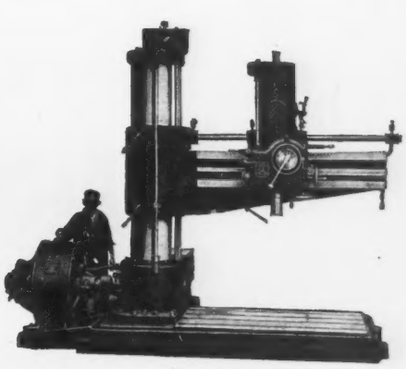
**Oakley, Cincinnati, Ohio, U. S. A.**

**Founded 1874**

R558



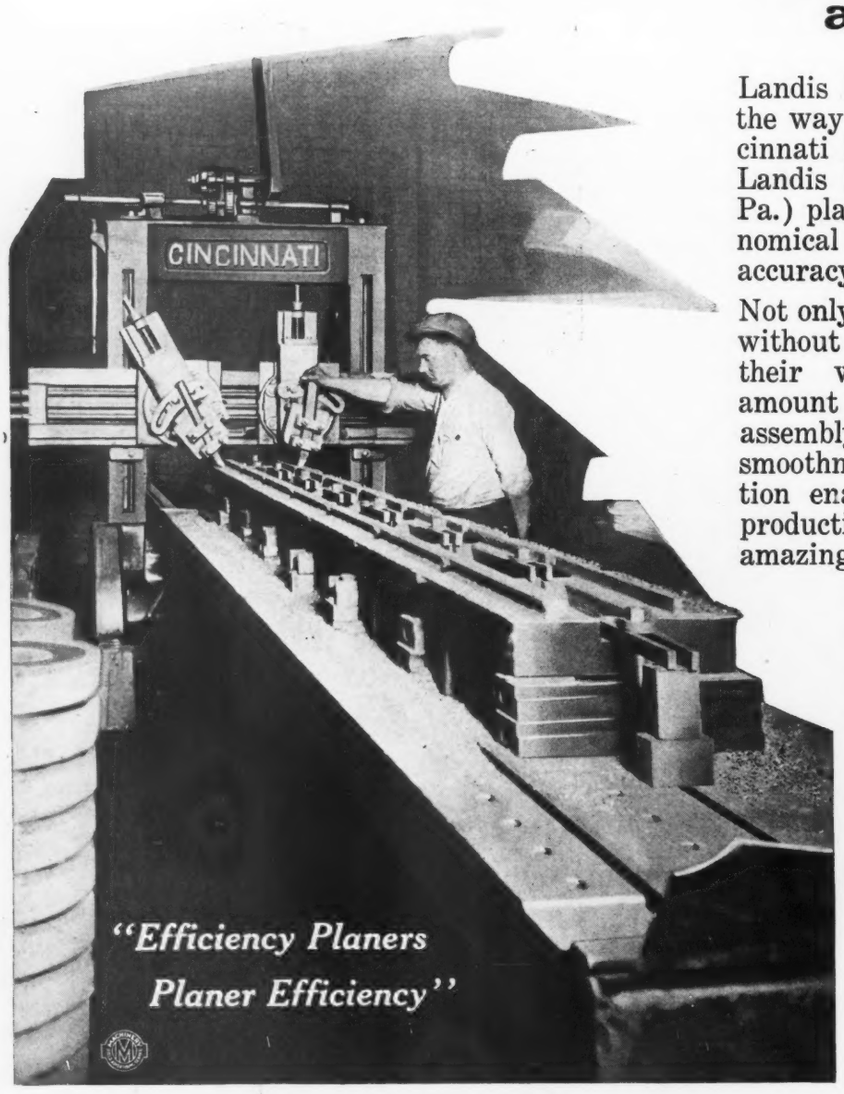




# CINCI

# TU-SPEED PLANER

## Where Close Limits are the Rule




Landis Machines are accurate "all the way through," and the five Cincinnati Planers in the shops of the Landis Machine Co., (Waynesboro, Pa.) play important parts in the economical achievement of this ideal of accuracy.

Not only do they work to close limits without difficulty, but the quality of their work greatly reduces the amount of finishing necessary in the assembly room, while the rapidity, smoothness and convenience of operation enable the operator to secure production that is little less than amazing.

Micrometer adjustments, graduated in thousandths, regulate the depth of the cut; the variable speed feature assures the right speed for the tools and the work.

Cincinnati Planers, used where high grade machines are built, spell profits to discerning manufacturers.

*Let us tell you more about them.*

# CINCINNATI PLANER CO

DOMESTIC AGENTS: Henry Prentiss & Co., Inc., New York City, N. Y., Boston, Mass., Buffalo, N. Y., Syracuse, N. Y., Rochester, N. Y. Motch & Merryweather Mchy. Co., Cleveland, O., Detroit, Mich., Pittsburgh, Pa., Cincinnati, O. Marshall & Huschart Mchy. Co., Chicago, Ill., St. Louis, Mo., Indianapolis, Ind. W. E. Shipley Mchy. Co., Philadelphia, Pa. Kemp Machinery Co., Baltimore, Md. Seeger Machine Tool Co., Atlanta, Ga. C. T. Patterson Co., New Orleans, La. Eccles & Smith Co., San Francisco, Cal., Los Angeles, Cal. Zimmerman, Wells & Brown Co., Portland, Oregon. Hallidie Mchy. Co., Seattle, Wash., Spokane, Wash. Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.

# NNATI

# RAPID PRODUCTION BORING MILL

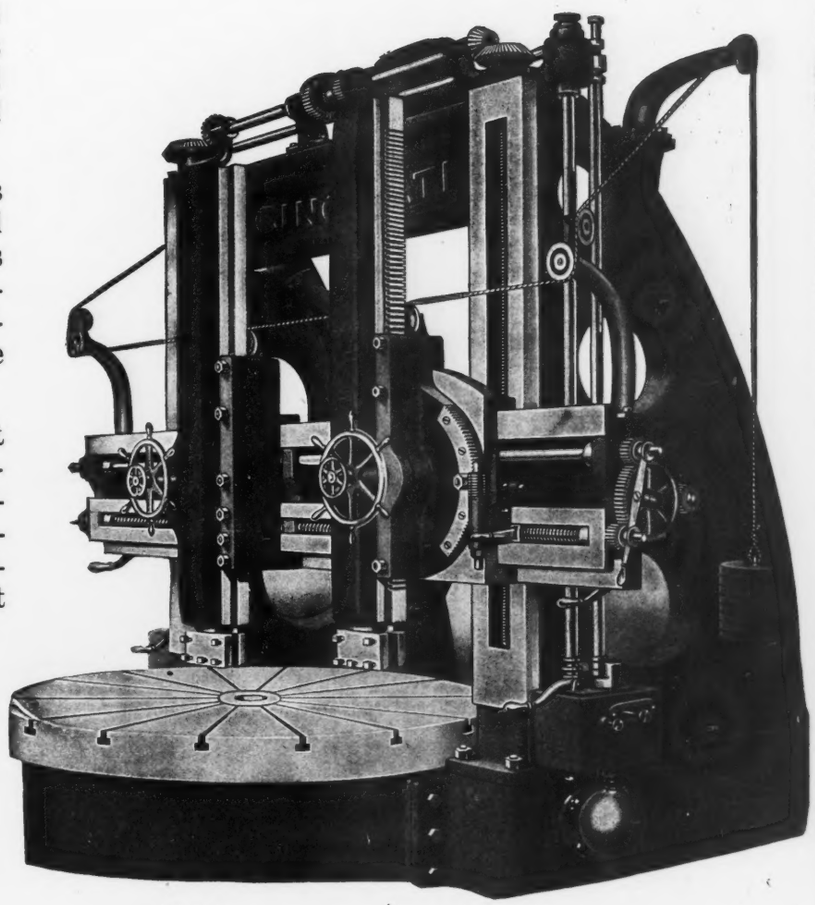
## Accuracy and Speed in a Massive Machine

The demand for accuracy reached in war time, when Uncle Sam set the limits and held the gauge, will not abate; the demand for speed seems to increase daily.

Time was, when big work was roughly finished and considered "well done," when accuracy was not expected of big machines; today, accuracy, speed and convenient operation are expected of large machines as well as small ones.

Which all brings us to the fact that Cincinnati Boring Mills are machines of *today*, built with a forward glance that comprehends *tomorrow's* need. Accurate, convenient, speedy, modern machines that give efficient service everywhere.

***Send for the specifications—***
***Let us tell you more about them.***



# MPANY, Cincinnati, Ohio, U.S.A.

CANADIAN AGENTS: Rudel-Belnap Mchy. Co., Toronto, Ont., Montreal, Que. FOREIGN AGENTS: Aux Forges de Vulcain, Paris, France. C. Churchill & Co., London, England, (Planers). Geo. H. Alexander, Birmingham, England, (Boring Mills). Ing. Ercole Vaghi, Milano, Italy. J. Lambercier & Co., Geneve, Switzerland. Chr. A. Herstad, Copenhagen, Denmark, Stockholm, Sweden. Gustav Nielson, A/S, Christiania, Norway. C. Schinz, Petrograd, Russia. Maskin-Aktiebolaget, E. Gronblom, Abo Finland. Ateliers Demoor, Brussels, Belgium. Andrews & George Co., Tokyo, Japan. Benson Bros. Co., Sydney, Australia. H. S. Gray Co., Honolulu, H. I.

# A CINCINNATI-ACME FLAT TURRET LATHE

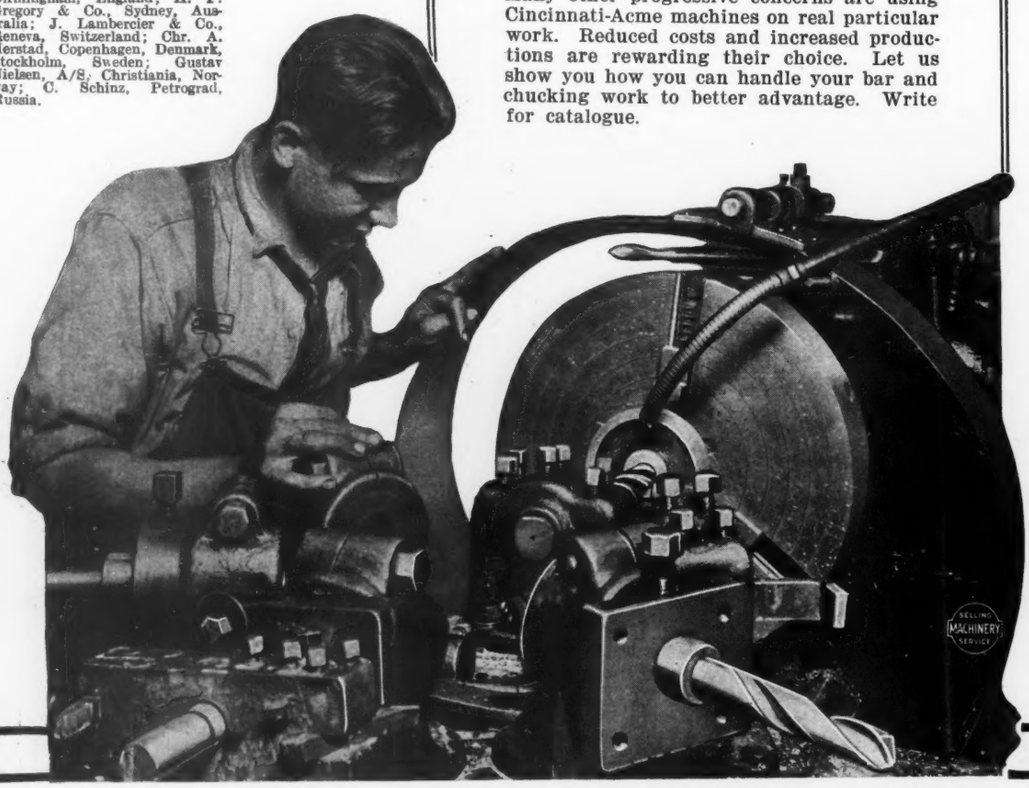
## *Finishing Kempsmith Gears*

THE Kempsmith Manufacturing Company of Milwaukee uses this Cincinnati-Acme Flat Turret Lathe for finishing gears to be used in milling machines. It drills, bores, turns, faces and chamfers, finishing parts with speed limited only by the quality it has to maintain. Limits are very close: diameter of hole is held to 0.00025″, outside diameter to 0.002″.

This company is very particular, but in no way during the three years the Cincinnati-Acme Flat Turret Lathe has been in this plant has it failed to come up to the full expectations of its owners.

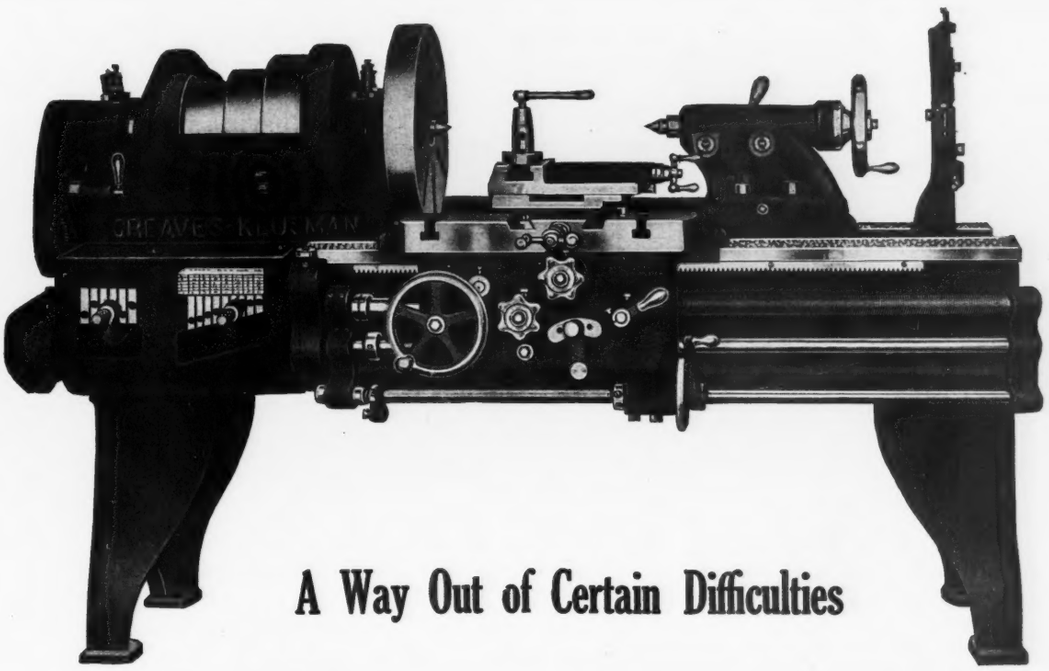
Many other progressive concerns are using Cincinnati-Acme machines on real particular work. Reduced costs and increased productions are rewarding their choice. Let us show you how you can handle your bar and chucking work to better advantage. Write for catalogue.

DOMESTIC AGENTS: Henry Prentiss & Co., Inc., New York City, Boston, Mass., Buffalo, N. Y., Syracuse, N. Y., Rochester, N. Y.; Motch & Merryweather Mchy. Co., Cleveland, Ohio, Detroit, Mich., Pittsburgh, Pa., Cincinnati, Ohio; Marshall & Huschart Mchy. Co., Chicago, Ill., Indianapolis, Ind.; Elliot & Stephens Mchy. Co., St. Louis, Mo.; W. E. Shipley Mchy. Co., Philadelphia, Pa.; Kemp Mchy. Co., Baltimore, Md.; Seeger Machine Tool Co., Atlanta, Ga.; C. T. Patterson Co., New Orleans, La.; Harron, Rickard & McCone Co., San Francisco, Cal., Los Angeles, Cal.; Zimmerman-Wells-Brown Co., Portland, Ore.; Hallidie Mchy. Co., Seattle, Wash., Spokane, Wash.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; English Tool & Supply Co., Kansas City, Mo.; Dewstoe Machine Tool Co., Birmingham, Ala.
FOREIGN AGENTS: Aux Forges de Vulcain, Paris, France; Geo. H. Alexander, Birmingham, England; H. P. Gregory & Co., Sydney, Australia; J. Lambercier & Co., Geneva, Switzerland; Chr. A. Herstad, Copenhagen, Denmark, Stockholm, Sweden; Gustav Nielsen, A/S, Christiania, Norway; C. Schinz, Petrograd, Russia.




ACME MACHINE TOOL CO., CINCINNATI OHIO, U.S.A.

# Greaves-Klusman Lathes




## A Way Out of Certain Difficulties

EVERY manufacturer gets his share of difficulties to contend with. New problems arise daily. There's always a way out. All that remains is to find quickly the best way out.

Greaves-Klusman Engine Lathes, remarkably adaptable machines, are continually showing the best way out of lathe difficulties. They satisfy requirements for speed, accuracy and convenience on most extraordinary classes of work. They are dependable in all emergencies. Greaves-Klusman Engine Lathes have many improvements in design, many refinements in construction; which combine to put G-K Lathes among the highest type machine tools on the market.

Apron is of double plate box form with removable plate; all gears are cut from steel forgings; bed is strongly reinforced under the Vs; carriage is extra heavy with full length bearing on each V; compound rest has no overhang and is held at any angle by four clamping bolts; headstock is massive and rigid, internally ribbed its entire length; and tailstock is unusually long.

***Made in sizes from 14 in. to 30 in. swing***
***Complete details will be sent upon request***

## THE GREAVES-KLUSMAN TOOL CO.

**CINCINNATI** **OHIO, U. S. A.**

The Fairbanks Co., New York City, Philadelphia, Washington, Baltimore, Albany, Boston, Buffalo, Hartford, Newark, New Orleans, Scranton, Syracuse, Trenton, Rochester, Providence, Bridgeport, Kansas City; Federal Machinery Sales Co., Chicago, Ill., and Milwaukee, Wis. J. R. Stone Tool & Supply Co., Detroit, Mich. William K. Stamets, Pittsburgh, Pa., and Cleveland, O. Marshall & Huschart Machinery Co., Indianapolis, Ind. Elliot & Stephens Machinery Co., St. Louis, Mo. Hallidie Machinery Co., Seattle, Wash. Hallidie Co., Spokane, Wash. Neill-LaVielle Supply Co., Louisville, Ky. Robert S. Armstrong & Bro., Atlanta, Ga. Dewstoe Machine Tool Co., Birmingham, Ala.

# Cincinnati Automatics

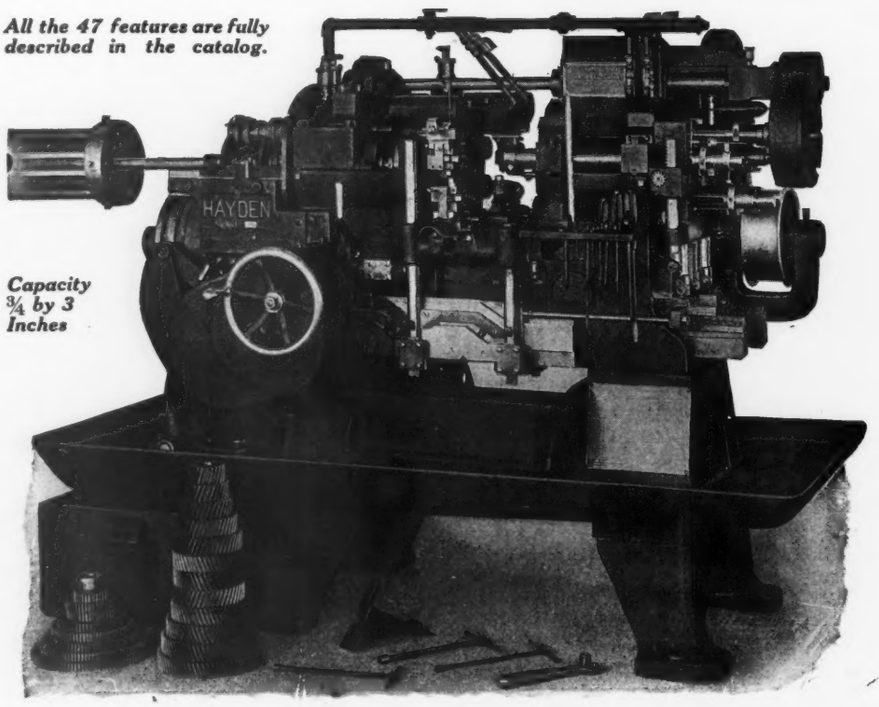
*"A Grain does not Fill a Sack but it Helps its Fellow"*

NONE of the 47 features of this Five-spindle Automatic can be selected as the most important advantage in the rapid production of small, accurately threaded duplicate parts for which the machine is designed.

The combination, however, provides for quantity, quality and economy of output which we claim set standards that *cannot be duplicated by any other method.*

We are prepared to prove this with time studies of actual performances or will demonstrate on your own work from samples or specifications.

*All the 47 features are fully described in the catalog.*




*Capacity ¾ by 3 Inches*

**Cincinnati Automatic Machine Company**

**OAKLEY** **CINCINNATI, OHIO**

"Gee, that's a beauty—"

# There's a Real He-Man Drill

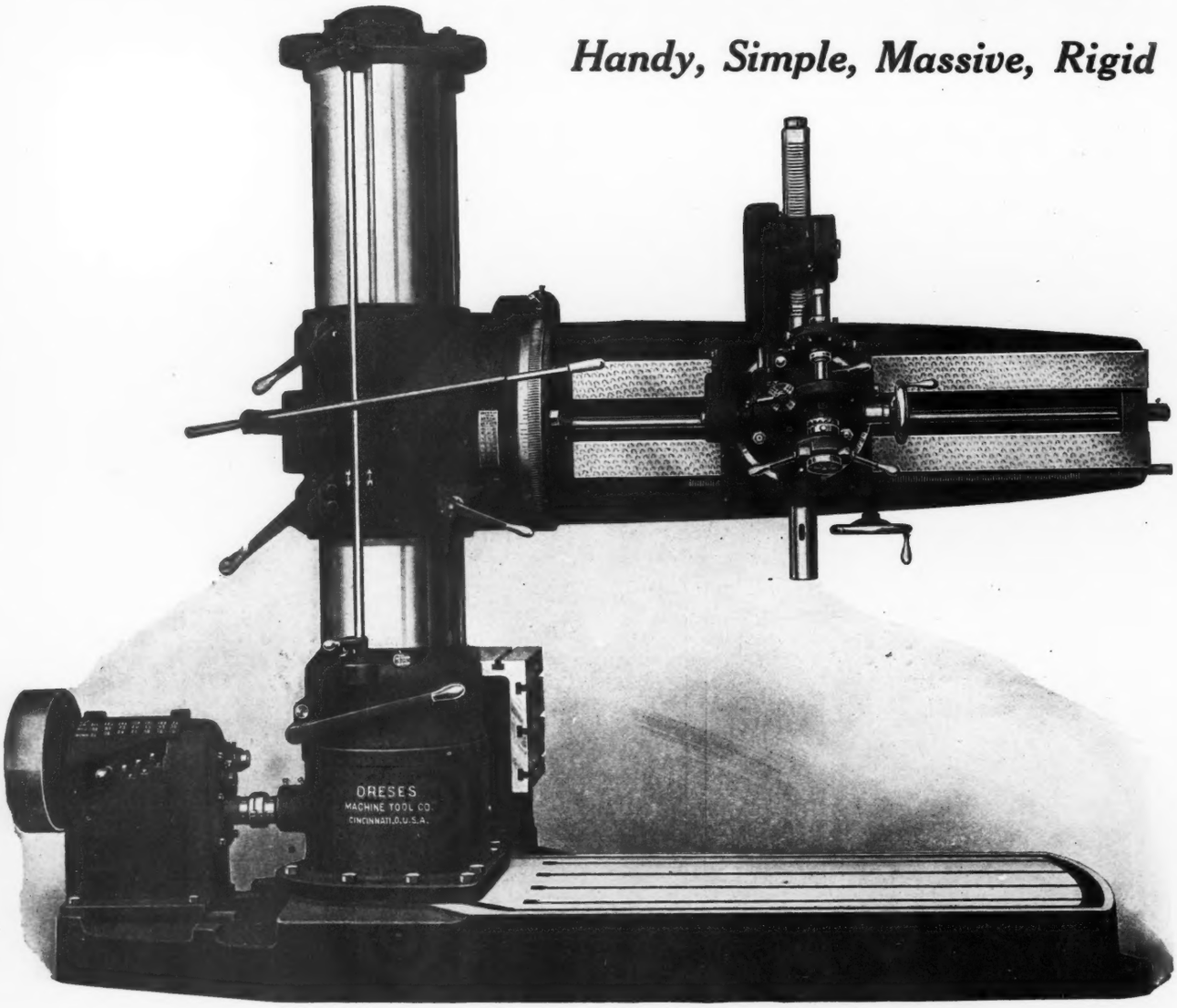
*It's a* CLEVELAND

THE CLEVELAND TWIST DRILL CO., Cleveland, New York, Chicago

Agents for Europe, CLEVELAND TWIST DRILL CO. (GREAT BRITAIN), Ltd., 36-37 Upper Thames St., London E.C.4.

# "DRESES" RADIAL DRILLS

*Handy, Simple, Massive, Rigid*




The "DRESES UNIVERSAL RADIALS" are original in design and differ in many ways from other machines. The arm socket is staggered to bring the center line of spindle close to the center line of column. This overcomes deflection when drilling, and provides also a long bearing for the shaft in the saddle. The head swivels in a deep recess of the saddle which affords easy setting and strengthens the saddle many fold. The spindle is balanced by differential pinions to avoid long travel of the balancing weight. The quick return to the spindle has two handles and positive clutches. The geared feed and automatic trip are of entirely new design and models of simplicity and easy manipulation. (All covered by patents.) Send for the circular.

## DRESES MACHINE TOOL CO., Cincinnati, Ohio

REPRESENTATIVES: Manning, Maxwell & Moore, Inc., New York, Boston, Philadelphia, Cleveland, Chicago, Detroit, Mexico City; Carey Machinery and Supply Co., Baltimore; Wm. C. Johnson & Sons Mchy. Co., St. Louis; Pacific Tool and Supply Co., San Francisco and Los Angeles; R. S. Stokvis & Zonen, Rotterdam; R. S. Stokvis & Fils, Paris and Brussels; Alfred Herbert, Ltd., Coventry.

# "MORSE"

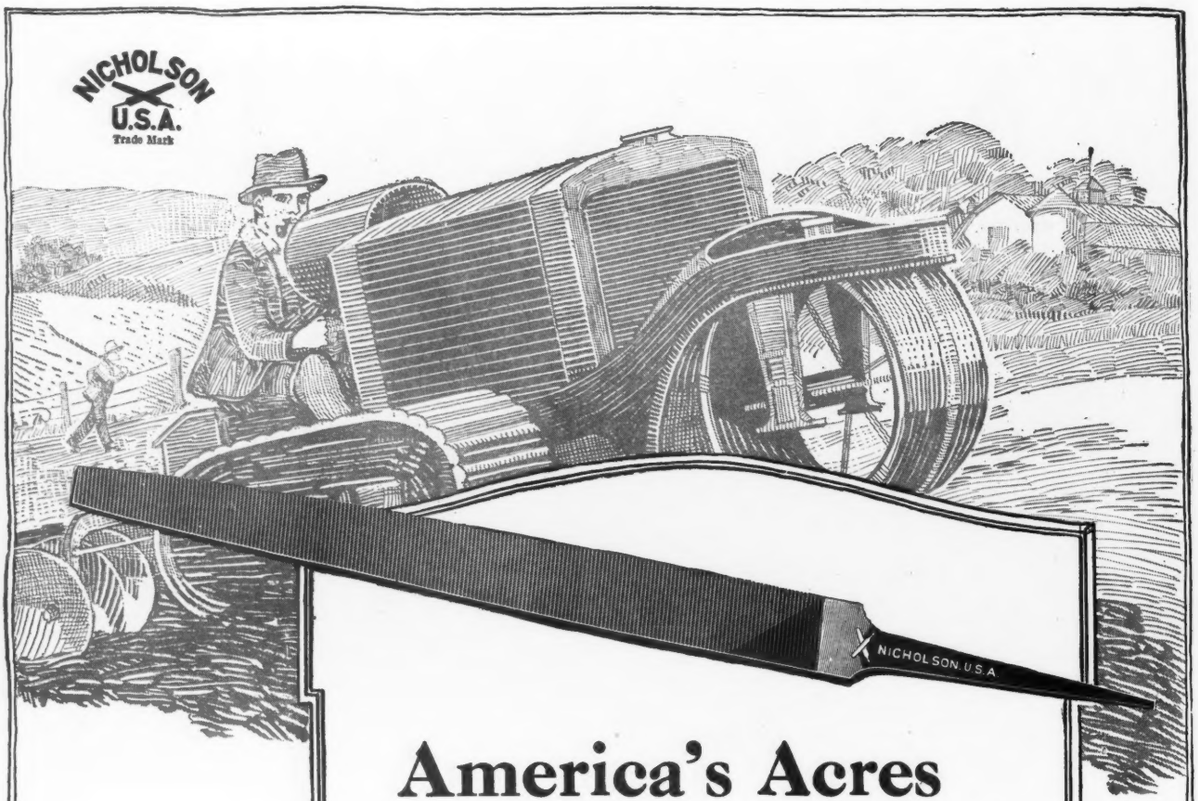
Quality

Accuracy

Endurance

**Morse Twist Drill & Machine Co.**

New Bedford, Massachusetts, U. S. A.




# America's Acres are Tractor-Tilled

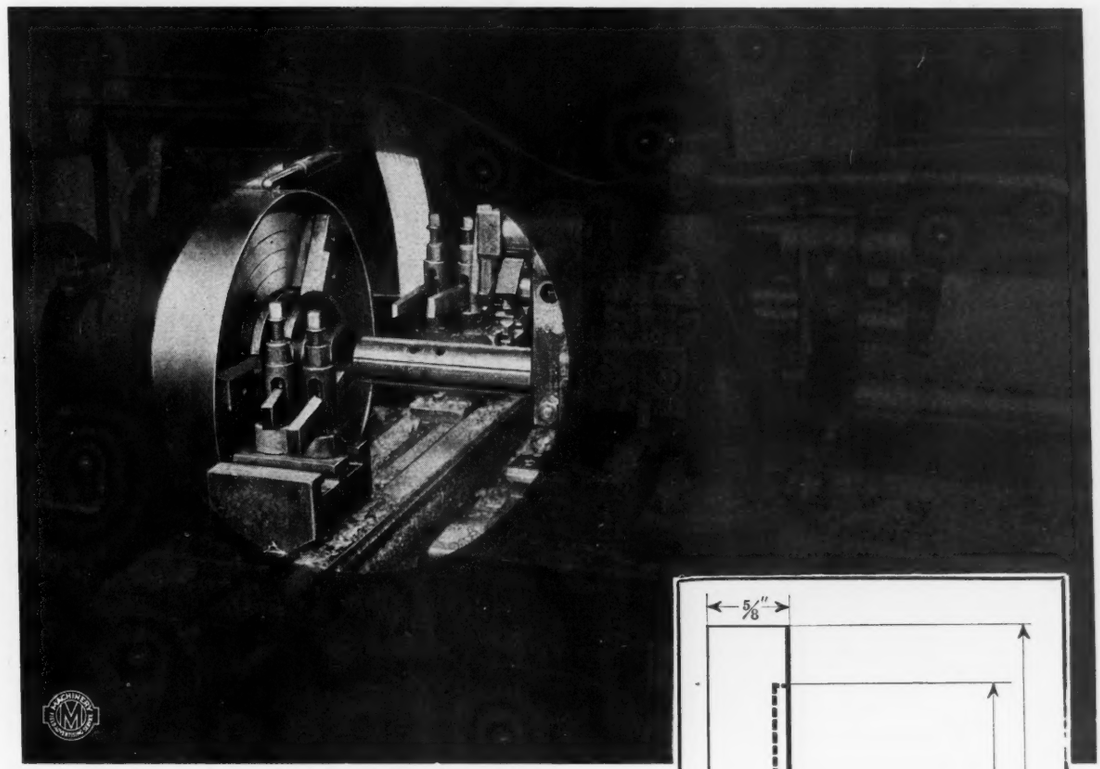
The wheat and corn acreage of America saved the world from starvation, and the American tractor made that acreage possible. Yet tractor tillage is but in its infancy. Tractors adapted to all tillage conditions are already developed or in the making, and

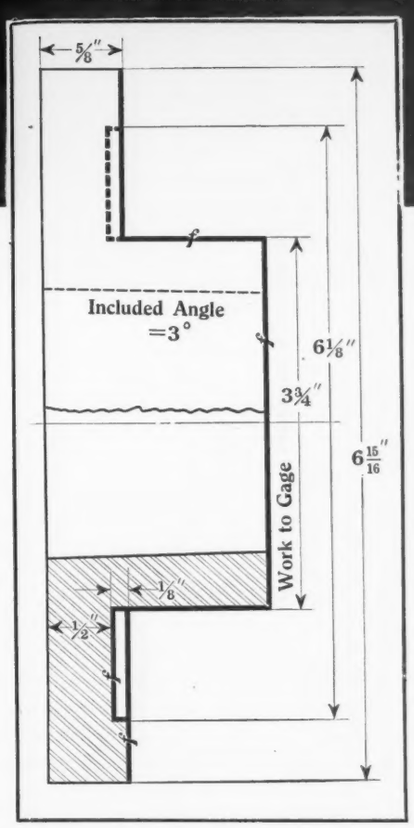
# Nicholson Files

are playing a worthy part in this significant development—smoothing and shaping the parts of these power units of agriculture. In the tool box of the working tractor, too, is found most frequently the File that cuts FASTEST and SMOOTHEST.

***Write for our catalog and for File Filosophy—a most instructive booklet about files and their use.***

## NICHOLSON FILE CO.
**PROVIDENCE, R. I. U. S. A.**






## A Typical Set-Up on a

# P. & J. Automatic

Get a line on this job now—you may want to know the best way to handle it any time. This is the second operation on chuck-bushing plates, and is completed in three turret indexings, together with double-tooled front and rear cross-slide tool posts. Heavy lines in sketch illustrate the work done.

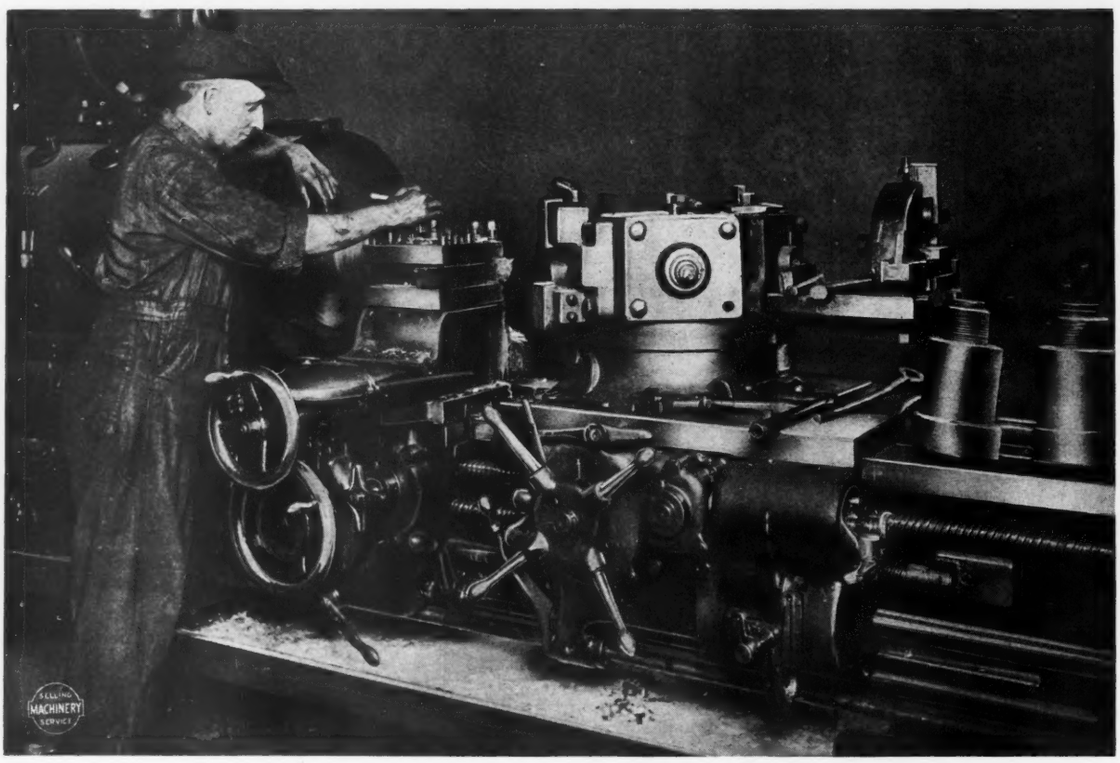
Operations are: first turret position, rough turn and rough face; second, rough undercut recess in flange; third, finish all over, including recess. Note that four tools are simultaneously engaged for the finishing cuts. Production time is 9 minutes for each piece machine time, and 2¼ minutes operator's time, for one man looks after four P. & J. Automatics.

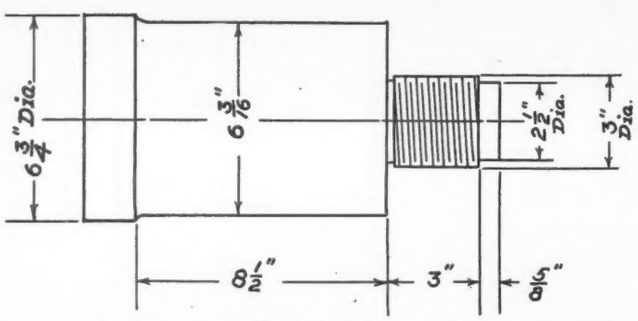
***We have an extensive collection of photographs showing P. & J. Automatics in action. Some of them illustrate jobs like yours. Production figures too. Write.***

## POTTER & JOHNSTON, Pawtucket, R. I.

OFFICES AND REPRESENTATIVES: Great Britain, France, Italy, Belgium, Switzerland, Spain and Portugal; 68 Avenue de la Grand Armee, Paris, J. Ryan, Manager. New York Office: Fulton Bldg., 50 Church St., Walter H. Foster Co., Managers. Detroit Office: Modern Machinery and Engineering Co., 1514 Ford Bldg. Chicago Office: 1001 McCormick Bldg., Chas. H. Shaw, Manager. Toronto Office: 1501 Royal Bank Bldg., E. C. Roelofson, Manager. FOREIGN AGENTS: Chas. Churchill & Co., Ltd., London, Birmingham, Manchester and Newcastle-on-Tyne, England and Glasgow, Scotland. Ercole Vaghi, Corso Porta, Nouva 34, Milan, Italy.

# A Libby Lathe on Cross-Head Pins






## *An Essential Equipment for the Railroad Shop*

Any large railroad shop can show an assortment of work calculated to tax machine tools to the limit. The one where this Libby Lathe does duty is no exception—hence the story:

The picture shows the "Libby" machining cross-head pins. Material is a forged steel bar approximately 6¾" diameter, and the schedule of operations, shown in the sketch, are as follows: feed out; turn 6 3/16" diameter, 8½" long; turn 3" diameter, 3" long, turn 2½" diameter, ⅝" long; thread and cut off.

Average time to complete one of these parts is 30 minutes with an ordinary operator at the wheel, but when a top notch mechanic takes a turn at the "Libby" he makes even better time.

Railroad shops are not the only ones where Libby Lathes are indispensable. Let us explain their wide range adaptability.

## INTERNATIONAL MACHINE TOOL CO.

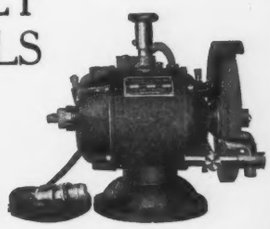
**INDIANAPOLIS** **INDIANA, U. S. A.**

DOMESTIC AGENTS: Bowman-Blackman Machine Tool Co., St. Louis, Mo. Brown & Zortman Machinery Co., Pittsburgh, Pa. Eccles & Smith Co., San Francisco, Cal., Los Angeles, Cal., Portland, Ore. E. L. Esaley Machinery Co., Chicago, Ill., Milwaukee, Wis., and Moline, Ill. Strong, Carlisle & Hammond Co., Detroit, Mich., and Cleveland, Ohio. Vandyck-Churchill Co., New York, N. Y., New Haven, Conn., and Philadelphia, Pa. Syracuse Supply Co., Syracuse, N. Y., and Buffalo, N. Y. Aumen Machinery Co., Baltimore, Md. Northern Machinery Co., Minneapolis, Minn. FOREIGN AGENTS: Coats Machine Tool Co., Ltd., London, Eng. Iznosskoff & Co., Petrograd, Moscow and Ekaterinburg, Russia. Hijo De Miguel Mateu, Barcelona, Spain. Isbecque & Company, Belgium. Moerch & Roumet, Paris, France.

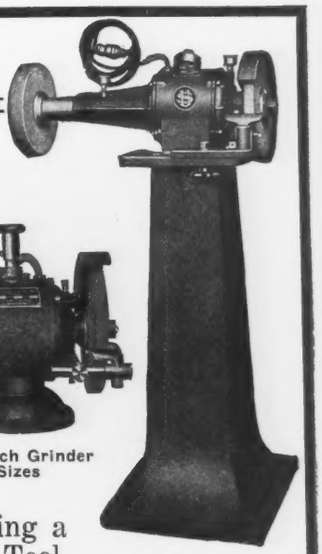
Ball Bearing Buffing Machine

ELECTRICALLY DRIVEN TOOLS

# Grinding and Buffing Machines



Type K Bench Grinder Four Sizes

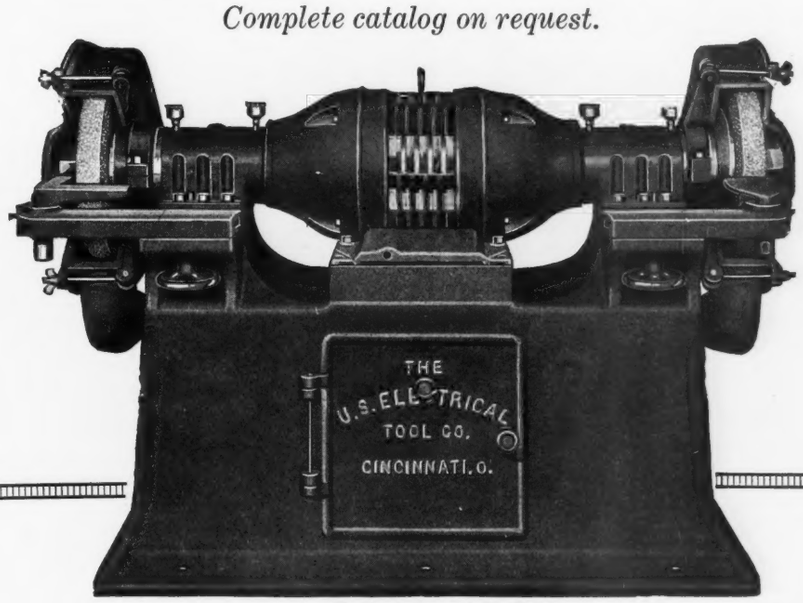


Combination Grinding and Buffing Machine. Two Sizes—Canvas or Wire Belts

There is considerable difference between installing a belt driven grinder and a U. S. Electrically Driven Tool. In one case, practically the whole department is held up during the major part of the operation—the other requires only to knock off the crate and make the electrical connection. U. S. Electric Grinding and Buffing Machines give uniformly satisfactory service; have split taper bearings—dustproof and adjustable—and the motors are specially designed for each machine and for the class of work to which it is to be applied.

We have had more than 32 years' experience in the building of electrical motors and tools. You get the full benefit when you buy U. S. Electrically Driven Tools—Grinding and Buffing Machines and Portable Drills and Grinders.

*Complete catalog on request.*




HEAVY DUTY GRINDER

## THE UNITED STATES ELECTRICAL TOOL CO.

**6th Ave. and Mt. Hope St., CINCINNATI, OHIO**

**STOCK CARRIED IN BRANCHES**

New York Office:
50 Church Street
Chicago Office:
549 West Washington Boulevard

St. Louis Office:
610 Commercial Building
Boston Office:
12 Pearl Street

Detroit Office:
18 Columbia St., West
Philadelphia Office:
The Bourse

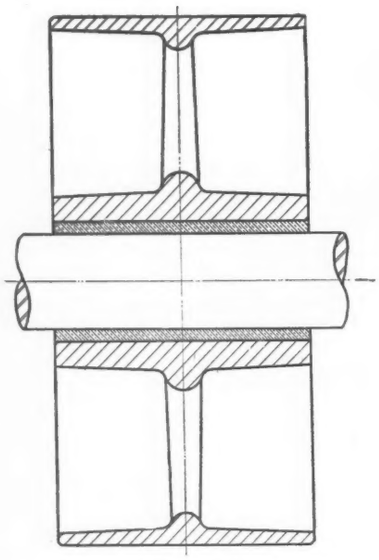


*Figure 1*

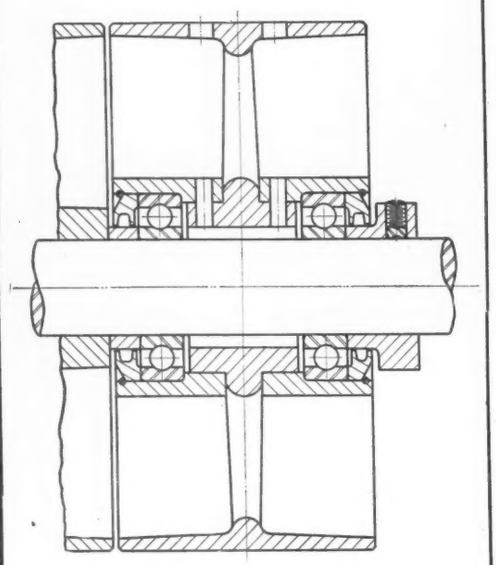


*Figure 2*

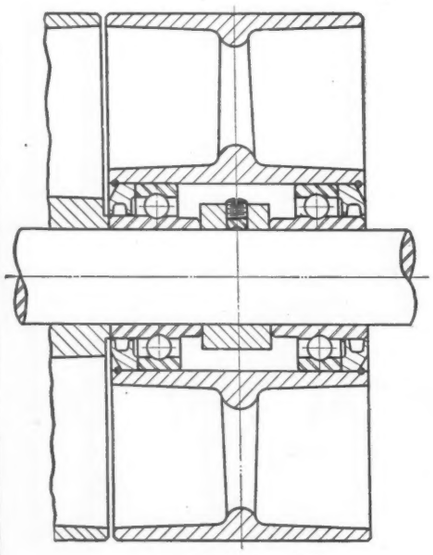


*Figure 3*

# FAFNIR
## BALL BEARINGS

### How to Re-Equip a Standard Plain Bushing Loose Pulley with Ball Bearings

To convert a standard plain bushing loose pulley into a ball bearing pulley—as illustrated in figure 1 and 2—first, remove plain bushing. Then face back each end of pulley hub sufficiently to make room for ball bearing and cap. Turn outside diameter of hub and square up shoulders at the spokes on each end.

Next, fit ball bearing housings over turned section at each end of hub. It is important that the housing be made a press fit on hub and pinned in place, in order to prevent slippage.

After they are in place on hub, bore out the housings to a press fit for outer rings of ball bearings selected. If pulley is very large, the housings can be bored out before fitting them to pulley, but in that case caution must be used to insure perfect alignment of bearing sections—otherwise, pulley will not run true.

Assemble ball bearing in housing at each end of pulley. Then insert cap which should be provided with grease or felt groove to prevent escape of lubricant. Finally, snap into place ⅛ inch spring wire which acts as a holding unit.

To mount pulley on shaft—

(1) Slide spacer bushing over shaft against tight pulley.

(2) Slide assembled bearings and pulley as a unit over shaft against spacer bushing.

(3) Finally, slide thrust collar into position against outside inner ring—but do not crowd—and tighten set screw.

### A Loose Pulley Originally Designed for Ball Bearings

Figure 3, illustrates a loose pulley designed by our Engineering Department especially for ball bearings. This particular pulley is easily constructed and has many fine qualities to recommend it. It will be observed that there are no shoulders and that it is only necessary to bore a straight hole through the hub and make grooves for cap retaining wires.

To mount pulley on shaft—

(1) Locate thrust collar on shaft and tighten set screw.

(2) Slip pulley over shaft.

(3) Slide left hand bearing into position; put cap in place, and insert retaining wire.

(4) Install opposite bearing in same way.

On receipt of blue print or sketch and sufficient working data, our Engineering Department will be glad of the opportunity to make recommendations covering in detail any specific application.

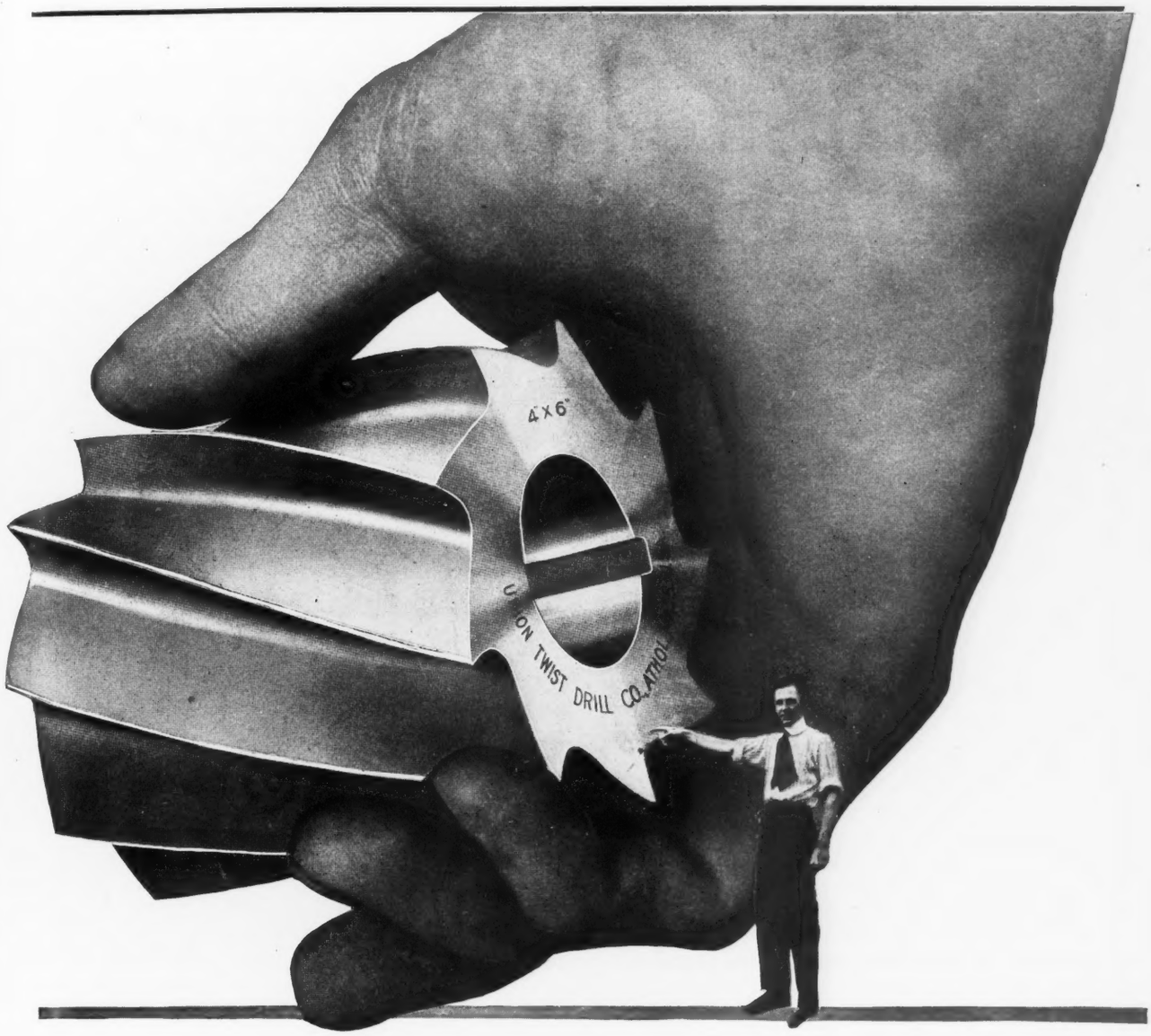
## THE FAFNIR BEARING CO.

Conrad Patent Licensee

New Britain, Conn.

DETROIT OFFICE
752 David Whitney Building

CHICAGO OFFICE
1301 So. Michigan Avenue




# Make Union Cutting Tools Standard in Your Plant

Uniform equipment helps considerably toward uniform production. Uniform production is a valuable asset.

There are "old reliables" in every line—time tried tools of uniform quality. In the cutting tool line, Union is in the forefront.

Make Union Cutting Tools standard in your plant, and get the most out of your machines.

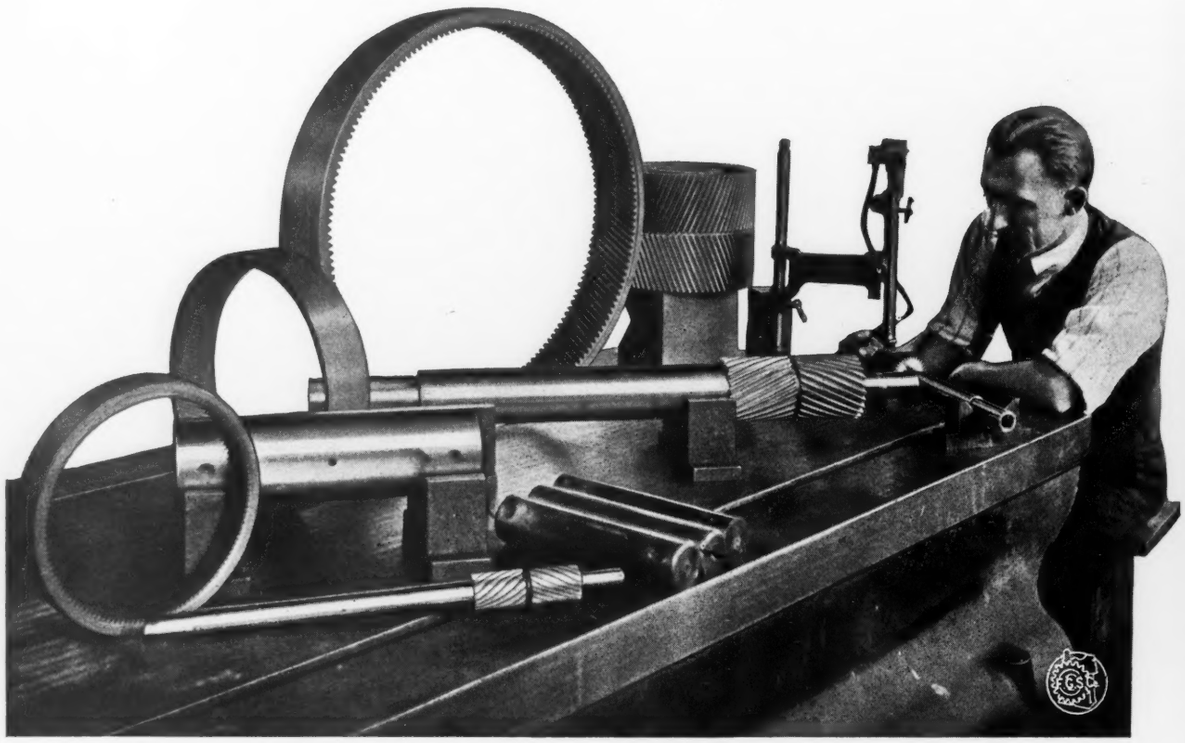
The Union line is complete. It includes heavy tools for extraordinary work in railroad shops, rolling mills, gear works and steel plants.

***Book of Information, Edition "H" gives a complete description of the line. Send for it today and keep it handy.***

## UNION TWIST DRILL CO., Athol, Mass.

# UNION

# Accurate and Efficient Reduction Gears



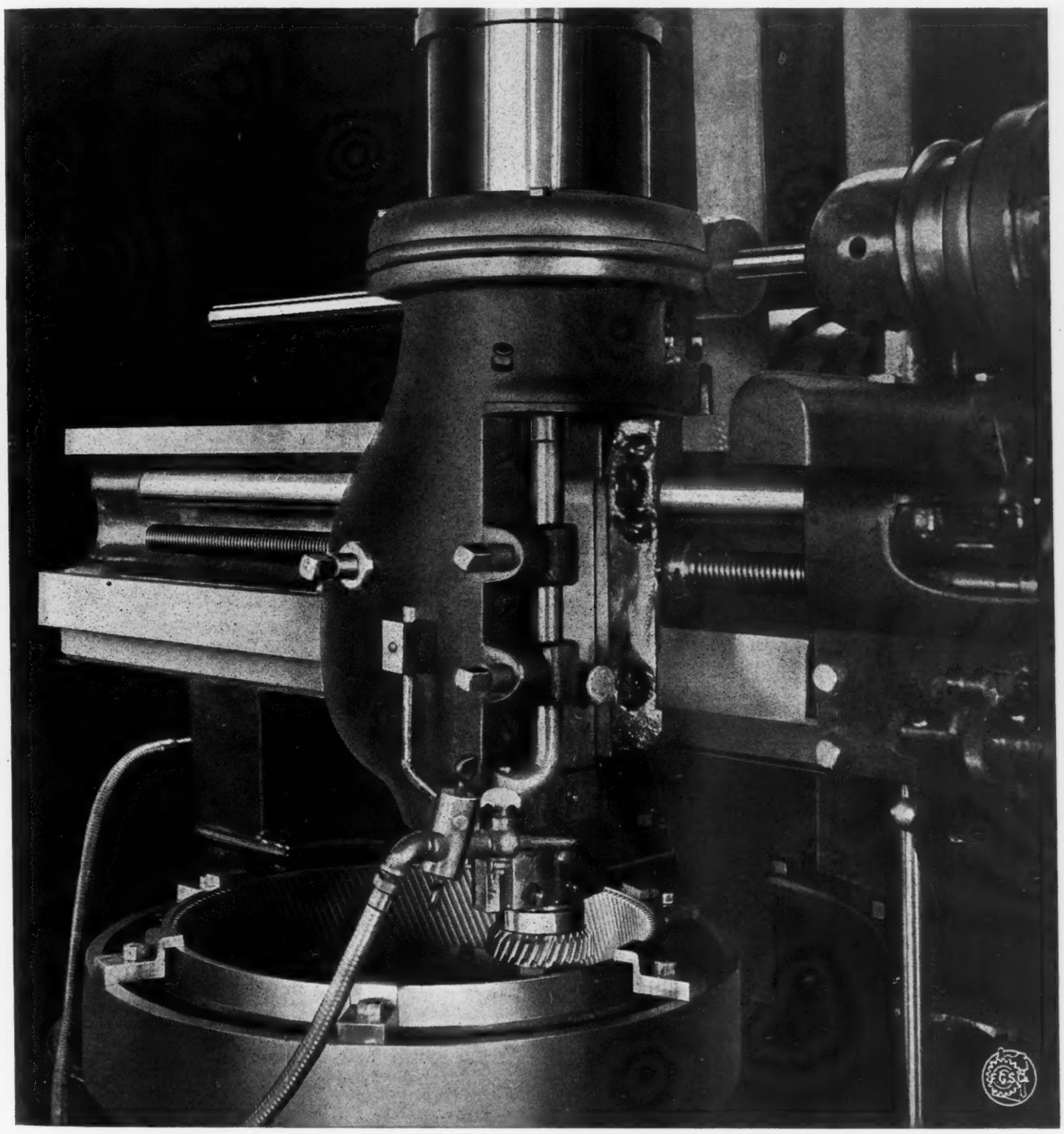
TESTING "POOLE" REDUCTION GEARS FOR HARDNESS

RELIABLE products are only possible when the manufacturing operations are under absolute control. The reduction gears built by the Poole Engineering & Manufacturing Company, Baltimore, Maryland, represent a product that is not only reliable, but is under absolute control from start to finish.

Every gear entering into these reduction gears is carefully tested both for accuracy, hardness, etc.

To produce a product of such refinement requires the best equipment available, so it is not unusual, therefore, to find that all of the gears entering into this reduction gear are generated on the Fellows Gear Shaper. From the smallest to the largest reduction gears—transmitting from 500 to 5000 H.P.—the Gear Shaper is used for generating the teeth of all of the gears.

The Fellows Helical Gear Shaper operates on a principle that is unique, and which is clearly described in our general catalog, "Commercial Gear Cutting." If you are interested in the cutting of accurate helical gears, a copy of this catalog will prove of interest and profit to you.



CUTTING INTERNAL MEMBER OF THE POOLE REDUCTION GEARS ON THE GEAR SHAPER

# THE FELLOWS GEAR SHAPER CO.

**SPRINGFIELD** **VERMONT, U. S. A.**

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, England; Yokohama, Japan; Calcutta, India; Societe Anonyme, Alfred Herbert, Paris, France and Spain; Societe Anonyme Belge, Alfred Herbert, Brussels, Belgium; Societa Anonima Italiana, Alfred Herbert, Milan, Italy; Aktiebolaget Galco, Stockholm, Sweden.

# The Field Artillery Mobile Repair Shop Had G & E Shapers of Course!

A great and memorable victory pageant was held in New York City, May 3, 1919, to help put the Victory Liberty Loan over the top.

In the martial array of the implements of war one unit that attracted considerable attention was the Field Artillery Mobile Repair Shop. The machines were mounted on motor trucks.

The photograph reproduced above, showing a Gould & Eberhardt Shaper, was taken just before the parade started. This shaper had been in service right up behind the guns in France, and was only one of an order for 54, for this kind of service, all motor driven.

*It shows that the armed forces of the United States appreciate the fact that a well seasoned shaper is essentially reliable.*

GOULD & EBERHARDT

"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY

ESTABLISHED 1833 NEWARK, N.J. U.S.A.

# Whitcomb-Blaisdell Lathes

## *And the Power of Suggestion*

The principal factors governing the selection of a lathe are—first, it must be productive; that, as a matter of course; then it must be sturdy, and as far as possible without vibration; and, particularly nowadays, it must be accurate. Ease of operation, also, counts for a great deal, for labor is high. When, quite a few years ago, the Whitcomb-Blaisdell Lathe was adopted by the Monarch Machine Works, Milwaukee, Wis., the firm knew it would get these qualifications; but what really clinched the matter was the large number of W-B lathes doing the very work for which they needed the machine.

The photograph shows the Whitcomb-Blaisdell lathe engaged in the exacting work of turning pistons for an oil motor. It's as busy as any machine in the Monarch shop, and has an unbroken record of satisfactory service since the day of its installation.

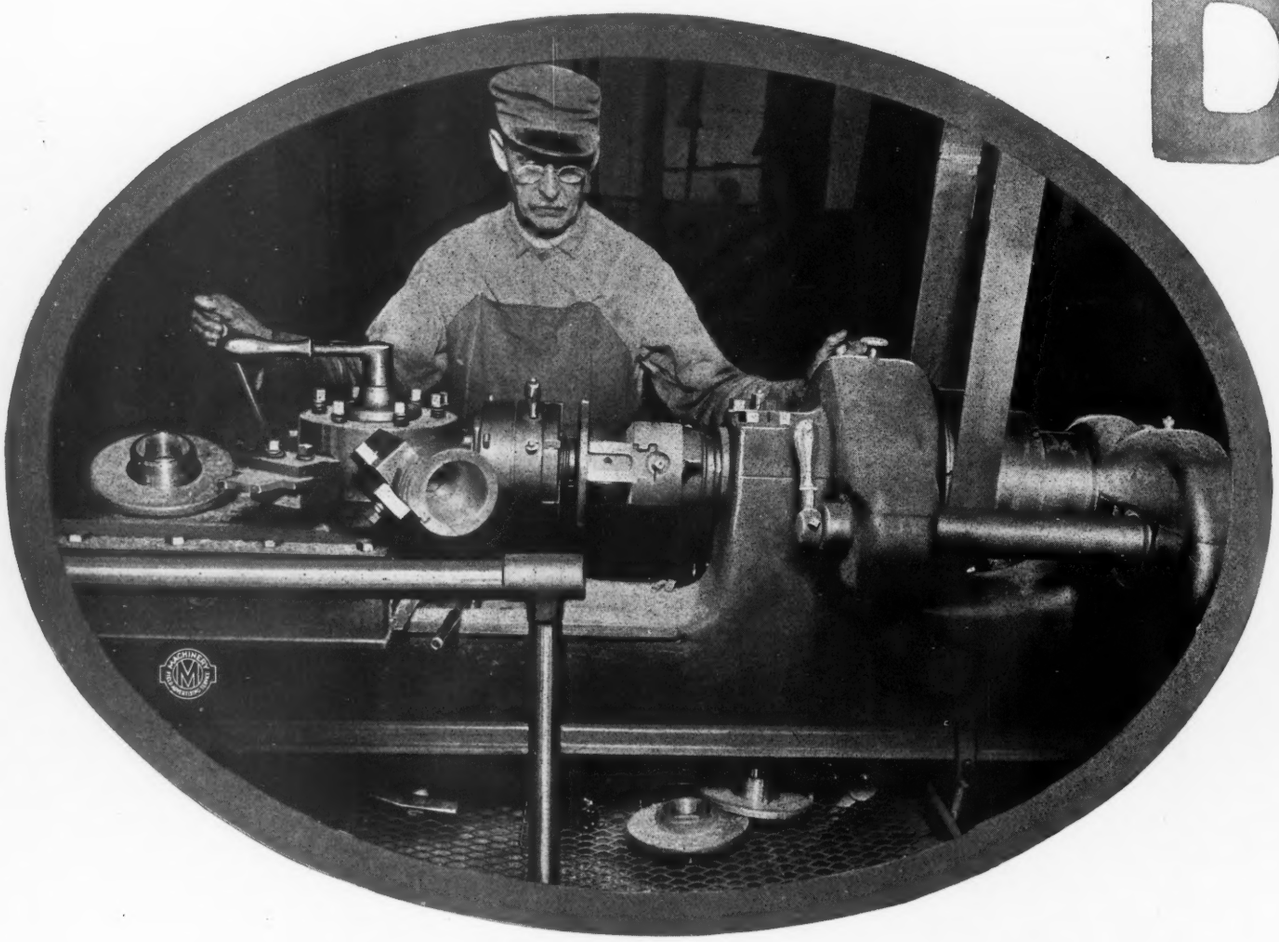
A Whitcomb-Blaisdell Lathe is not only a reliable, versatile machine, but a permanent investment which pays interest every day. It will do your work and do it well—why not look into its merits? The first step is the Catalog—write for it.

## Whitcomb-Blaisdell Machine Tool Co.

**WORCESTER** **MASSACHUSETTS**

# GEOM

# D



## A Tough Threading Job in Navy Brass for the Emergency Fleet Corporation

## THE GEOMETRIC TOOL CO.,

REGULAR AGENTS: The Chas. A. Strelinger Co., Detroit; Hill, Clarke & Co., Inc., Boston; Vandyck Churchill Co., New York and Philadelphia; Brown & Zortman Machinery Co., Pittsburgh; The E. A. Kinsey Co., Cincinnati; Strong, Carlisle & Hammond Co., Cleveland; The National Supply Co., Toledo; Western Sales Agents, The Tool Equipment Co., San Francisco. CANADA: The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N. B.; Williams & Wilson, Ltd., Montreal.

# ETRIC
# IE HEADS

Though "reconstruction" has for some months been satisfactorily substituted for "destruction," the word "Emergency" still stands in the name of the mercantile marine. By which token we understand the German bottoms will no longer float American exports, nor German freight-smashers do their bit for the Fatherland on the high seas.

Geometric Die Heads are helping to build ships. The job shown is a casting of special brass. So much stock must be removed that two cuts are necessary. Diameter is $3\frac{1}{32}''$, and there are 8 threads to the inch. In all, there are four operations, the time required for the threading, which is the last, being less than 25 per cent; so if we were to give the production for the threading alone, it would be more than 120 an hour; we will content ourselves with the production record for the four operations, however, which is 30 per hour.

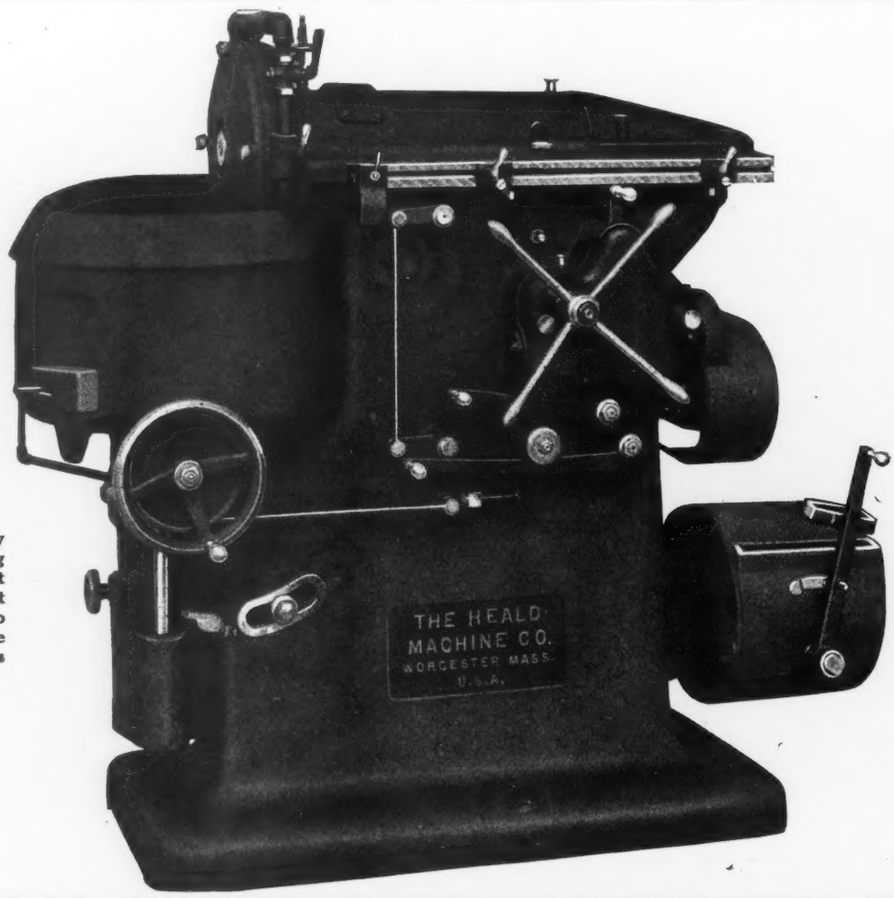
We don't know of anybody connected with the Emergency Fleet Corporation who isn't a booster for Geometric Die Heads. If Geometrics can meet emergencies they can more than make good in ordinary usage. If, however, you test them on any specially difficult thread cutting operation, give our camera man a pass, so we can put your job on these pages.

***Get the right Geometric combination for YOUR requirements. We'll help you select it.***

CHICAGO, OFFICE:
627 W. Washington Blvd.

# NEW HAVEN, CONN.

FOREIGN AGENTS: Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne, Glasgow. E. Isbecque & Co., Antwerp and Brussels, Belgium. V. Lowener, Christiania, Stockholm and Copenhagen. Bevan & Edwards Pty., Melbourne, and White and Rae, Sydney, Australia. Andrews & George, Tokyo, Japan. Allied Mchy. Co. of America in France, Switzerland, Italy, Spain and Portugal. J. Horstmann, Paris. Also all manufacturers of Screw Machines and Turret Lathes.




**The Heald Rotary Surface Grinding Machine is all that you would expect a Heald product to be—representative of the best of its class.**

# New—The Heald Rotary

## *The Latest Heald Product*

The new Heald Rotary Surface Grinding Machine marks the latest step in the evolution of surface grinders. Massively built, yet simple in both construction and operation, this machine has all the mechanical refinements required to give necessary speeds and adjustments to turn out the best work.

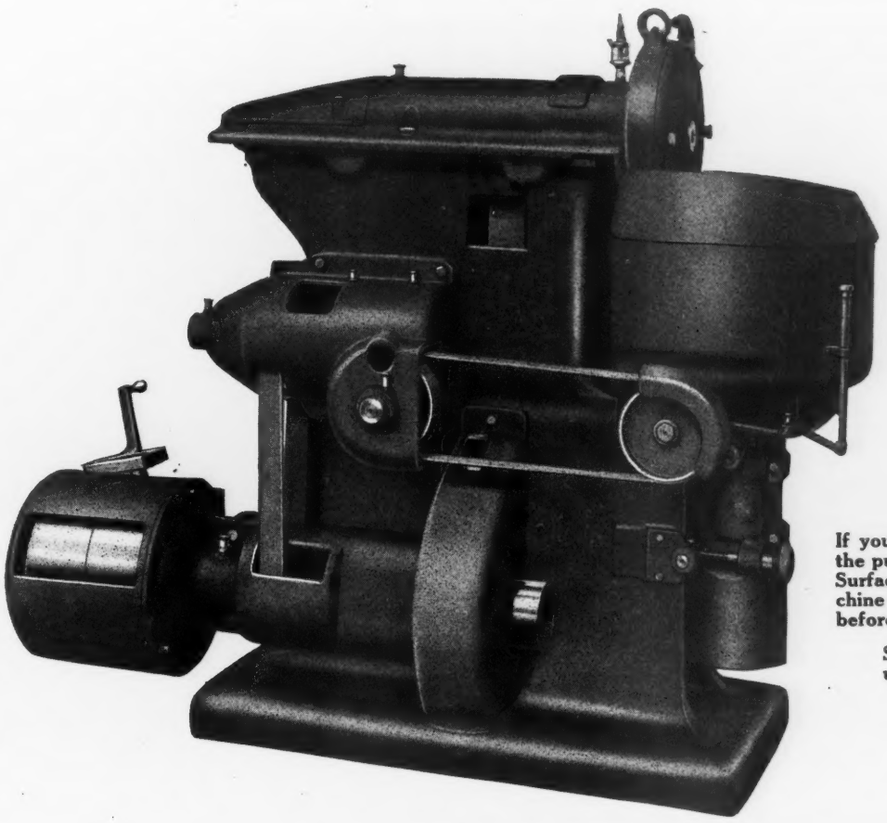
The wheel slide is a massive casting having a flat and "V" way insuring continued alignment. Bearing surfaces are large and well protected. Spindle belt operates with a downward pull; an important factor in rigidity.

The chrome nickel steel wheel spindle is mounted in large bearings all adjustments of which are made at grinding wheel end through an opening in top of slide.

The main drive unit receives power from the main line by tight and loose pulleys, transmitting it directly by belt to main speed box, wheel spindle and pump.

# THE HEALD MACHINE CO.,

BRANCH OFFICES: New York, 839 Singer Bldg. Philadelphia, 1308 Commonwealth Bldg. Chicago, 26 South Jefferson St. Detroit, 401 Marquette Bldg. Cincinnati, 311 Provident Bank Bldg. Cleveland, 721 Engineers Bldg. WESTERN AGENTS: Eccles & Smith Co., Los Angeles, San Francisco and Portland. Salt Lake Hardware Co., Utah and Idaho.



**If you are interested in the purchase of a Heald Surface Grinding Machine get your inquiry before us early.**

**Specifications upon request.**

# Surface Grinding Machine

## *Now Ready for Delivery*

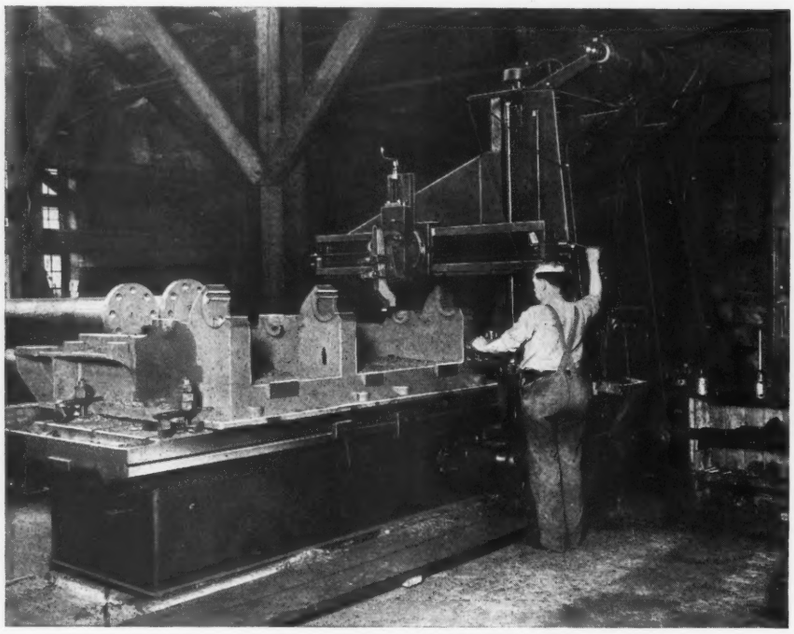
Main speed box, situated on the rear of machine, furnishes power to wheel slide by a 3-step cone, and operates the chuck, which has three speeds, through a bank of gears. Wheel slide and chuck are independent of each other, permitting a large latitude in speeds and feeds.

Chuck spindle is driven by spiral gears, one of which is mounted directly on the spindle. Spindle itself is mounted in a sleeve which has vertical adjustment. Upper portion rests in a taper bearing, lower end being equipped with ball bearings—wear is automatically taken up. All control levers and adjustments are within easy reach of operator.

Complete water apparatus is furnished with each machine; built in two sizes 8″ and 12″ with Heald Magnetic Chuck as regular equipment. Motor drive if desired.

# Worcester, Massachusetts, U. S. A.

FOREIGN AGENTS: Alfred Herbert, Ltd., England. Societe Anonyme, Alfred Herbert, France, Switzerland, Spain and Portugal. Societa Anonima Italiana, Alfred Herbert, Italy. F. W. Horne Co., Japan. Wilh. Sonesson & Co., Sweden, Denmark and Norway. Henri Benedictus, Brussels, Belgium.



# The CLEVELAND OPENSIDE PLANER

Twenty years building planers—and using them—has developed this machine. Construction is accurate, simple and convenient; all working parts are easily accessible; unique design and wide range guarantee efficient, economical operation on all classes of planing—large and small.

Sizes 26" to 72"—any table length.

Catalogue gives the details—let us send it.

CHICAGO OFFICE
435 Stock Exchange Bldg.

INDIANAPOLIS OFFICE
316 Terminal Bldg.

**THE CLEVELAND PLANER CO.**
ESTABLISHED 1900
3152 SUPERIOR AVENUE
CLEVELAND, OHIO, U.S.A.

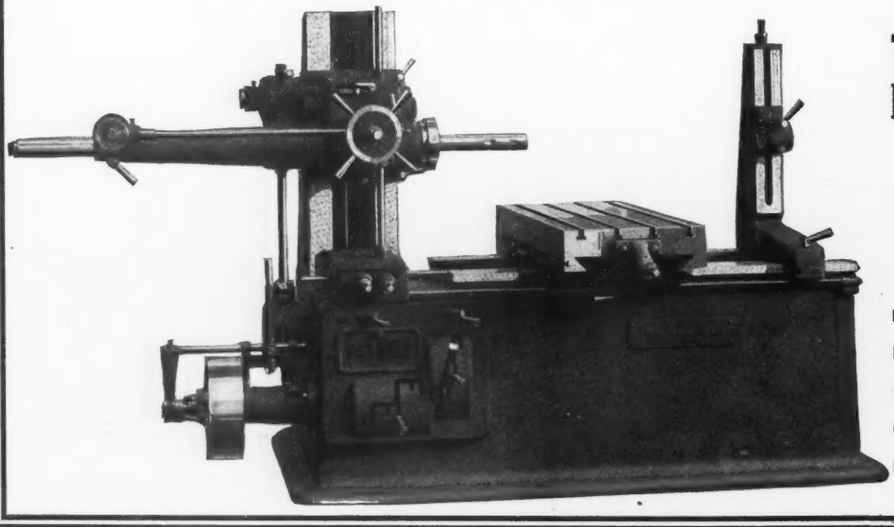
NEW YORK OFFICE
1760-2 Woolworth Bldg.

DETROIT OFFICE
705 Dime Bank Bldg.

PITTSBURGH OFFICE
203 Oliver Bldg.

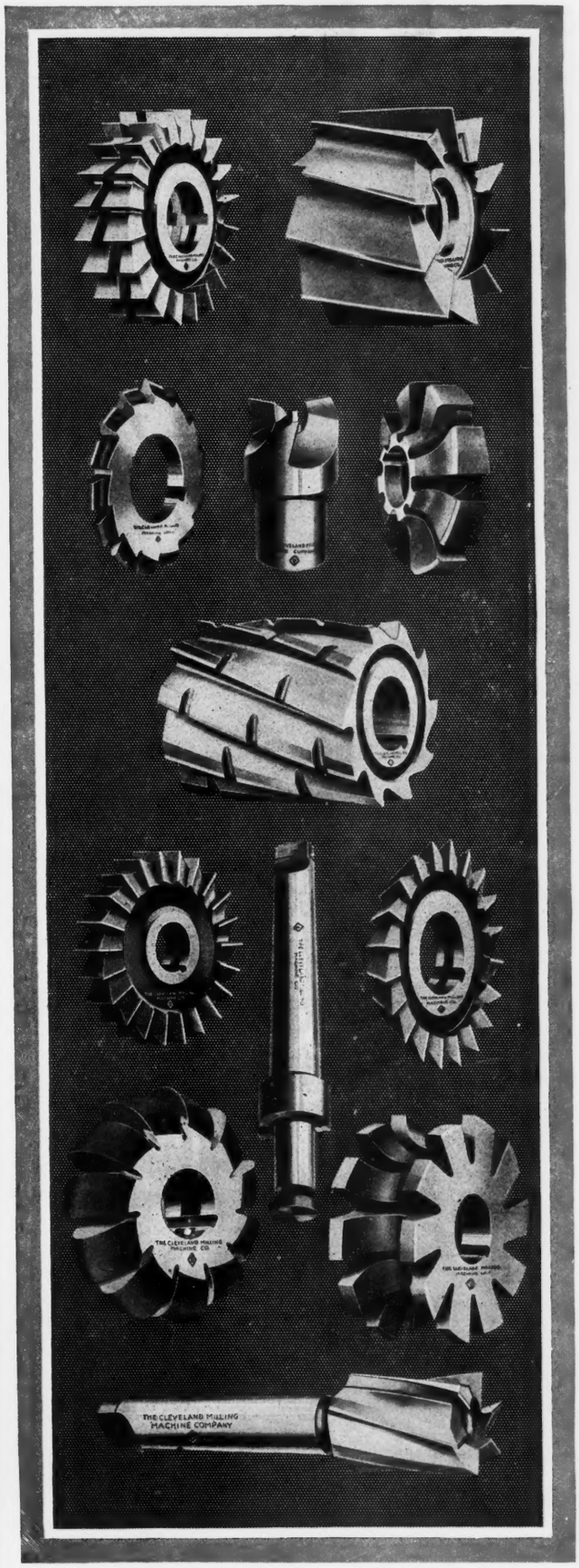
# The Reliability of the Cleveland Horizontal BORING DRILLING MILLING MACHINES

is assured under any conditions that may arise. This is proven by the excellent service these machines are giving in this country and abroad, both in government and private shops. Have you our illustrated catalog?



**THE CLEVELAND MACHINE TOOL COMPANY**
3215 Superior Ave.
Cleveland, Ohio
Established 1907

New York Office:
Woolworth Building
Detroit Office:
715 Dime Bank Building
Indianapolis Office:
316 Terminal Building
Chicago Office:
435 Stock Exchange
Pittsburgh Office:
203 Oliver Bldg.




*In Addition to Cutters We Manufacture:*

**Plain & Universal Milling Machines**
**Universal Cutter and Hob Relieving Machines**
**Profile Grinders**
**Special Tools**
**Special Reamers**

***We solicite your inquiries***

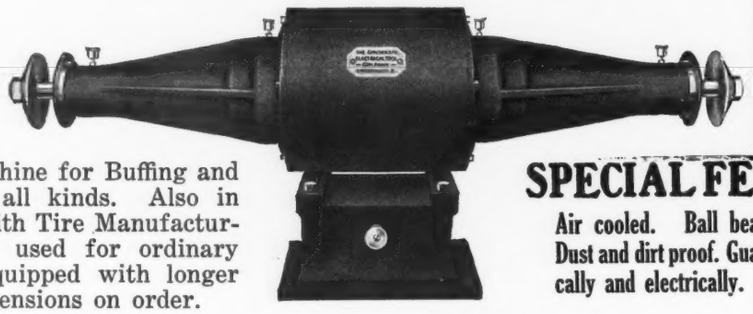
Service — THE CLEVELAND MILLING MACHINE COMPANY — Courtesy

**The Cleveland Milling Machine Company**
**CLEVELAND OHIO**

New York Office: 1760-2 Woolworth Building
Detroit Office: 705 Dime Bank Building
Indianapolis Office: 316 Terminal Building
Chicago Office: 435 Stock Exchange Building
Pittsburgh Office: 203 Oliver Building

# "Cincinnati" Electric Bench Buffer and Polishing Lathe

**No belts or pulleys needed**



**Furnished with floor pedestal if desired**

A special machine for Buffing and Polishing of all kinds. Also in general use with Tire Manufacturers. Can be used for ordinary grinding. Equipped with longer or shorter extensions on order.

**SPECIAL FEATURES:**

**Air cooled. Ball bearing throughout. Dust and dirt proof. Guaranteed mechanically and electrically.**

**Made in 1-2, 1, 2 and 3 H.P. Direct or Alternating Current.**

**Also complete line of Portable Electrical Drills and Grinders.**

**POWER FROM ANY LAMP SOCKET.**

## THE CINCINNATI ELECTRICAL TOOL CO.

**1501-3-5 Freeman Avenue CINCINNATI, OHIO**

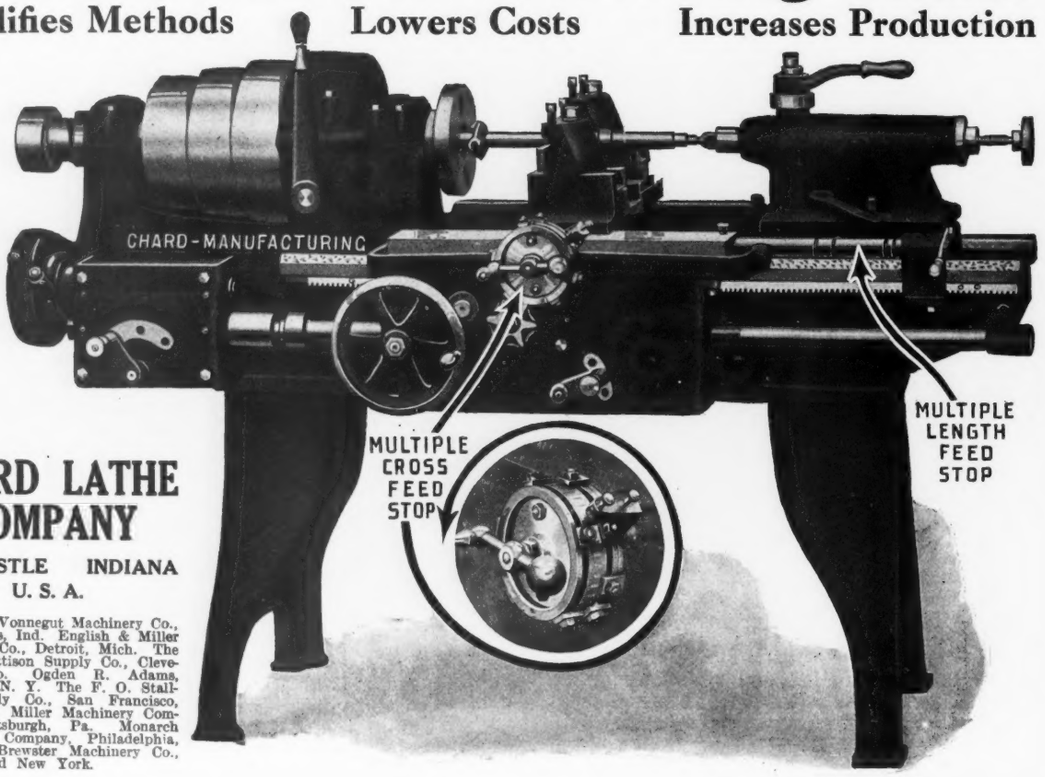
**NEW YORK OFFICE, 50 Church St** **BOSTON OFFICE, 259 Franklin St.** **DETROIT OFFICE, 2 Goebel Bldg**

FOREIGN AGENTS: England, S. Wolf & Co., London. Australia, Parke & Lacy Co., Ltd., Sydney. Norway, V. Lowener, Christiania. France, R. S. Stokvis & Fils, Paris. Holland, R. S. Stokvis & Zonen, Ltd., Rotterdam. Japan, Yamatake & Co., Tokyo. Spain, American Machinery Syndicate, New York City.

# The Chard Manufacturing Lathe

**Simplifies Methods Lowers Costs Increases Production**

*Let us prove these claims—Write today*




## CHARD LATHE COMPANY

**NEWCASTLE INDIANA U. S. A.**

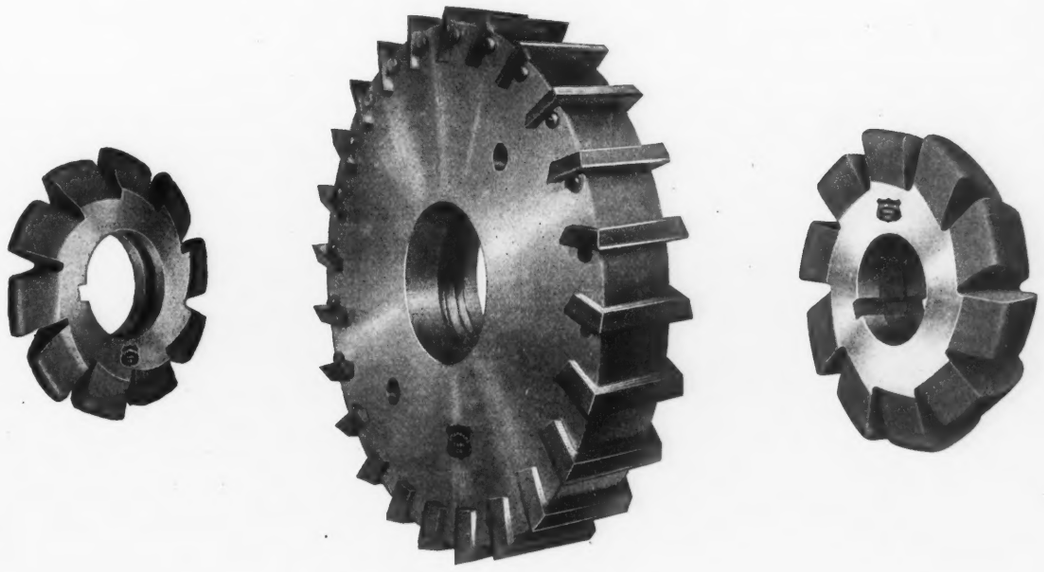
AGENTS: Vonnegut Machinery Co., Indianapolis, Ind. English & Miller Machinery Co., Detroit, Mich. The W. M. Pattison Supply Co., Cleveland, Ohio. Ogden R. Adams, Rochester, N. Y. The F. O. Stallman Supply Co., San Francisco, Cal. J. S. Miller Machinery Company, Pittsburgh, Pa. Monarch Machinery Company, Philadelphia, Pa. Dale-Brewster Machinery Co., Chicago and New York.

The

# SHIELD BRAND

IS THE MARK OF BEST QUALITY IN

# CUTTERS



CARBON AND HIGH SPEED

## THE STANDARD TOOL CO

CLEVELAND, OHIO

New York Store, 94 Reade Street
Chicago Store, 522 W. Washington Boulevard
Great Britain—Burton, Griffiths & Co., Ltd., London
France—Burton Fils, Paris
Switzerland—J. Lambercier and Cie., Geneva
Denmark—Nienstaed & Co., Copenhagen
Japan—The F. W. Horne Company, Tokyo
Spain-Portugal—American Machinery Syndicate, Barcelona, Madrid, Lisbon

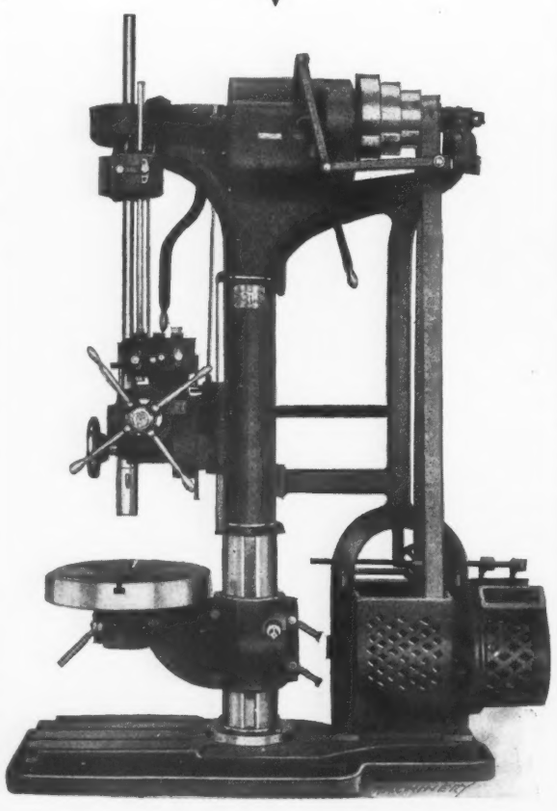
# COMPLETE

The Weigel Drilling Machine is genuinely complete. It has a solid foundation, a heavy, well-ribbed base, accurately scraped into alignment with column, and a column of tubular section with generous bearings for table arm and sliding head. Table has exceptionally heavy face to guard against spring from work or clamps. Table arm is raised and lowered by rack and pinion operating through a worm and worm gear. There are 8 feeds for each spindle speed ranging from .0040″ to .0432″ per revolution of the spindle, change obtained through sliding gears.

Drills to center of a 25⅝″ circle. Has friction geared tapping attachment mounted directly on spindle with reverse motion of 2 to 1 for spindle. When tapping with back gears thrown in, spindle has reverse motion of 12.88 to 1 by throwing back gear lever onto direct drive.

**Further details sent on request.**

*"That's the Weigel"*



**THE WEIGEL MACHINE TOOL CO.**

**PERU, INDIANA**



# HARTNESS

***NUMBER 4 — TYPE R***

# Automatic Die Head

**FOR USE ON REVOLVING SPINDLES VERTICAL AND HORIZONTAL**

FOR use on automatic and bolt cutting machines on which the tools revolve. May be mounted on either horizontal or vertical spindles. Is relocked by a sleeve which may be operated by a yoke or by engaging a fixed stop on the return movement. Diameter of sleeve is 6⅜″; length of die is 5 3/16″. Is unlocked in the usual manner by retarding forward motion or by external tripping button (A) contacting with a fixed stop. This is especially advantageous for cutting very short threads. Suitable for right or left threads, ¼″ to 1¼″ diameter. Supplied with shanks to meet particular needs.

***Write for further details.***

## Jones & Lamson Machine Co.

**Automatic Die Department**

**SPRINGFIELD, VERMONT, U. S. A.**

**109 Queen Victoria St., London, Eng. 503 Market St., San Francisco, Cal.**

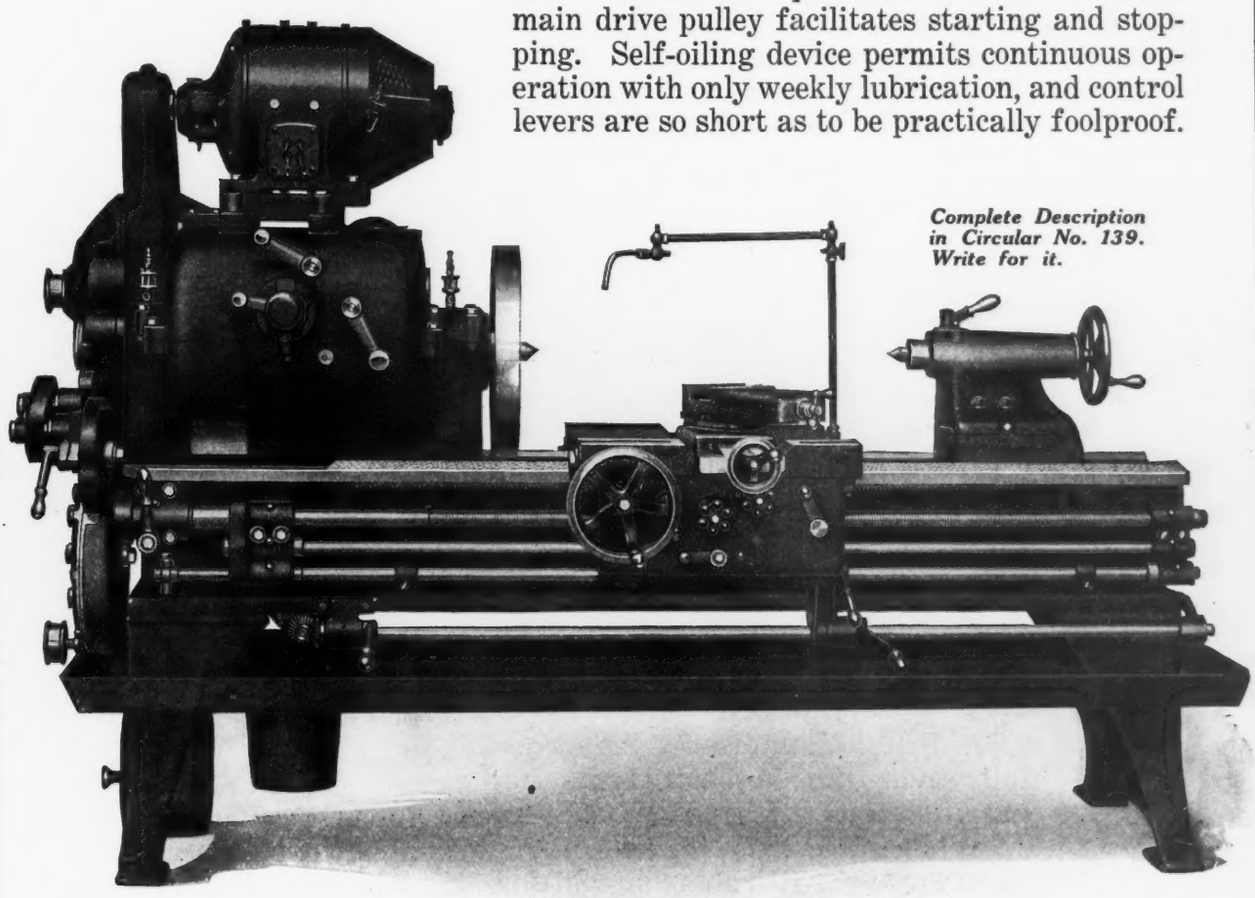
AMERICAN AGENTS FOR DIES AND CHASERS: Boyer-Campbell Co., Detroit. Carey Mchy. & Supply Co., Baltimore. E. L. Essley Mchy. Co., Chicago, Milwaukee and Moline. Machinists Supply Co., Pittsburgh. The E. A. Kinsey Co., Cincinnati, Indianapolis and Columbus, O. The W. M. Pattison Supply Co., Cleveland. Robinson, Cary & Sands Co., St. Paul and Duluth. A. V. Wiggins & Co., Syracuse. D. Nast Mchy. Co., Bourse Bldg., Philadelphia, Pa. FOREIGN AGENTS: For France, Spain and Belgium: F. Auberty & Co., 91 Rue de Maubeuge, Paris. For Holland: Spliethoff, Beeuwkes & Co., Rotterdam. For Australia: McPherson's Pty., Melbourne. For Argentina: Alsina & Cagnoni, Buenos Aires. Mitsui, Bussan Kaisha Ltd., Tokyo and Osaka, Japan; Dairen, Manchuria; Seoul, Korea; Taihoku, Formosa. A. B. Galco, Ltd., Stockholm, Sweden.

# SPRINGFIELD

## 18" by 8' Ideal Geared Head Engine Lathe

**Equipped with Ball Bearings**

SPRINGFIELD Lathes are well qualified to meet the demands of modern shop practice. This All Geared Head "Ideal" possesses all the most approved facilities for rapid, accurate production—all being unusually well developed. It is equipped with the "Ideal" Patented Rapid Change Gear device which has had 18 years' constant, hard service and is distinctive for its simplicity, power and range. All bearings, except the main spindle bearing, are ball bearing—including the thrust. Heavy, compact construction throughout, with short, heavy power shafts of large diameter, insures freedom from vibration and chatter. Special friction clutch in the main drive pulley facilitates starting and stopping. Self-oiling device permits continuous operation with only weekly lubrication, and control levers are so short as to be practically foolproof.



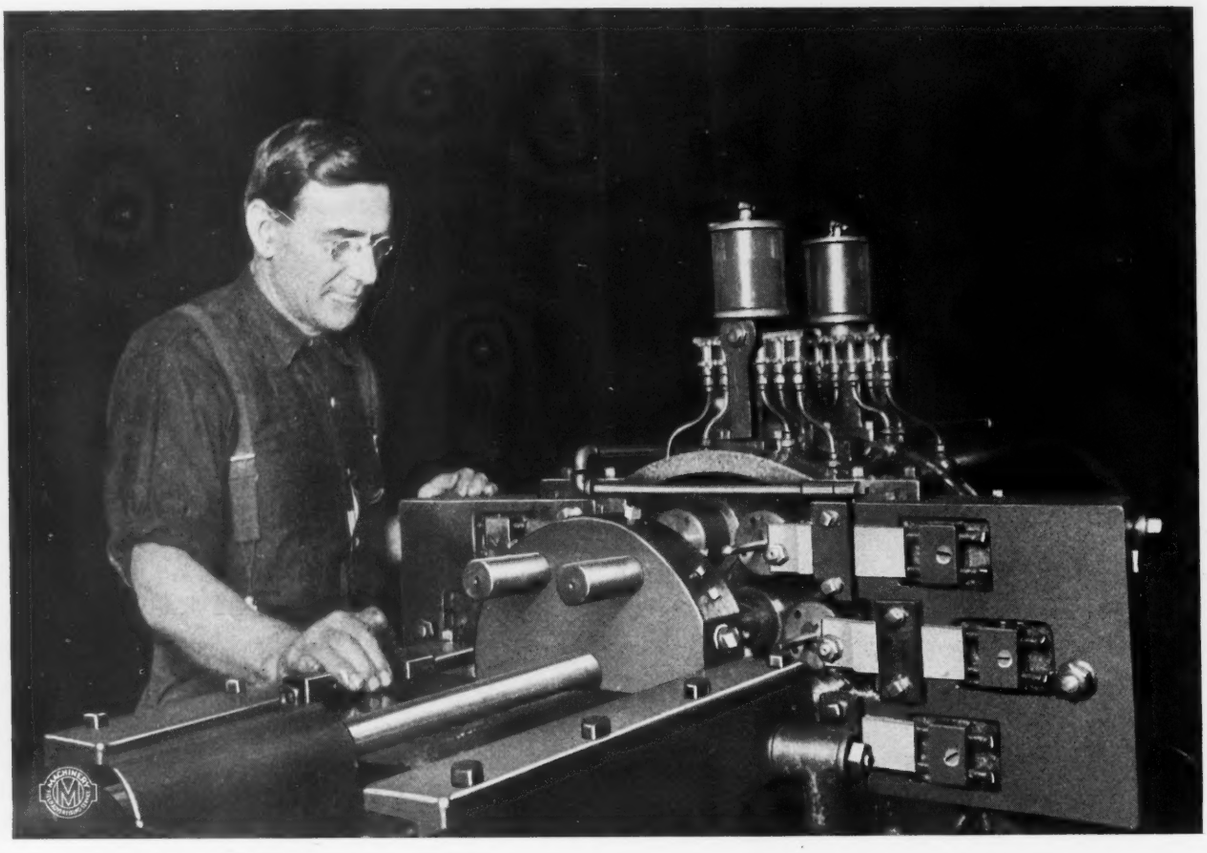
*Complete Description in Circular No. 139. Write for it.*

**THE SPRINGFIELD MACHINE TOOL COMPANY**

*Manufacturers of Springfield Lathes and Shapers*

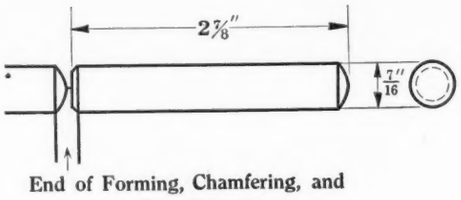
**631 SOUTHERN AVENUE** **SPRINGFIELD, OHIO, U. S. A.**

# NEW BRITAIN



## Sextuple Bar Machines Speed Production

There is a commodity which the world is running shorter of every day; which, once lost, can never be regained; and that is—*time*. Time is now paid for at a higher rate than it ever was before in the history of the world.



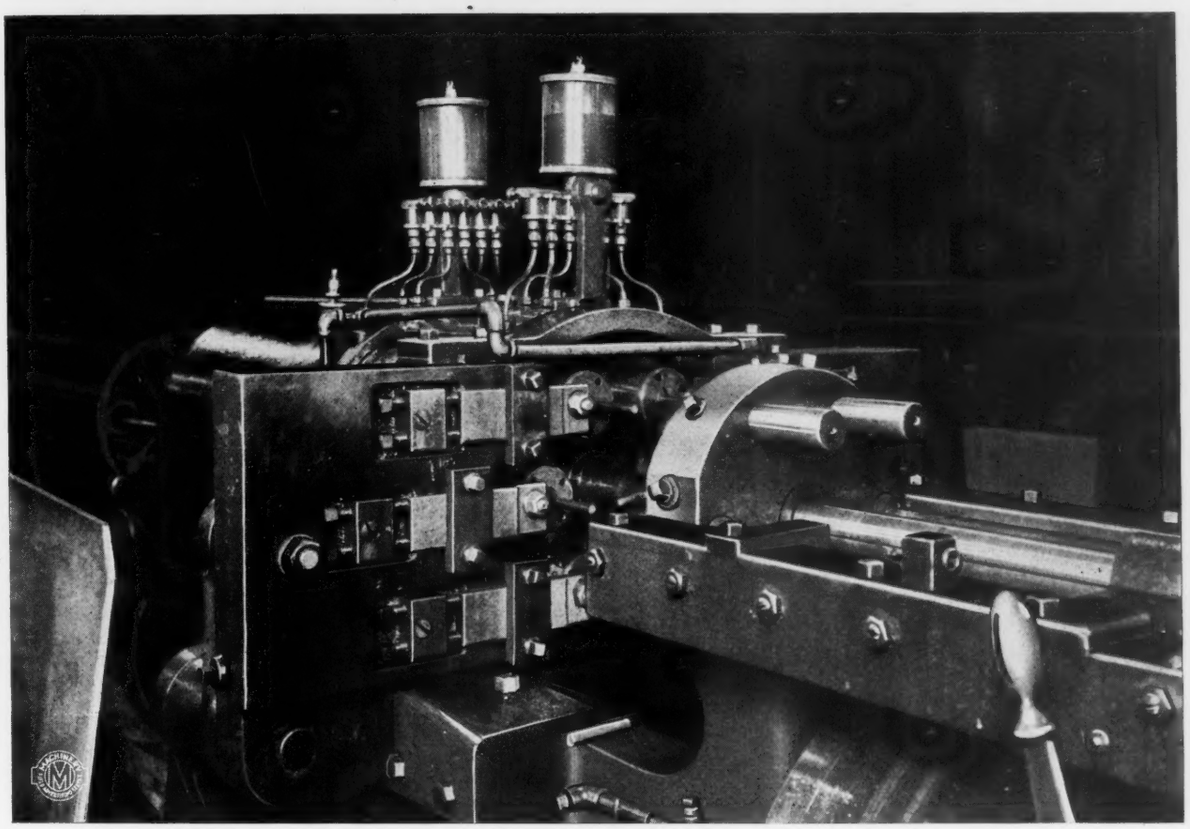

End of Forming, Chamfering, and Cut-off Tool

"New Britain" Automatics are successfully saving time in hundreds of different mechanical industries. The Sextuple Automatic Bar Machine produces almost *six times* the amount of work obtainable with a single spindle automatic. It will feed, drill, face, chamfer and cut off in six spindle positions simultaneously.

***"New Britain" production figures are determinable in advance. Write for them in connection with your work.***

# THE NEW BRITAIN MACHINE

# AUTOMATICS



## for the Continental Motors Corporation

The Continental Motors Corporation, Muskegon, Mich.—through whose courtesy these photographs were taken—is strongly in favor of "New Britain" Automatics, and has three of them in Department No. 15-A, where the accompanying photo was taken.

The machine—shown in two positions—is turning out *ten thousand studs per day*, yet uses *less than a third of one man's time.* One tool only—as will be seen by sketch—is employed for each spindle position, which tool forms, chamfers and cuts off.

"New Britain" Sextuple Machines are similar in general construction to the N. B. Automatic Screw Machines, except for the lock of the indexing feature. They are profitably employed on such simple work as rolls, sleeves, pipe couplings, stud and nut blanks, etc., and make fine finish and bulk production a profitable combination.

"NEW BRITAIN" NB NONE BETTER

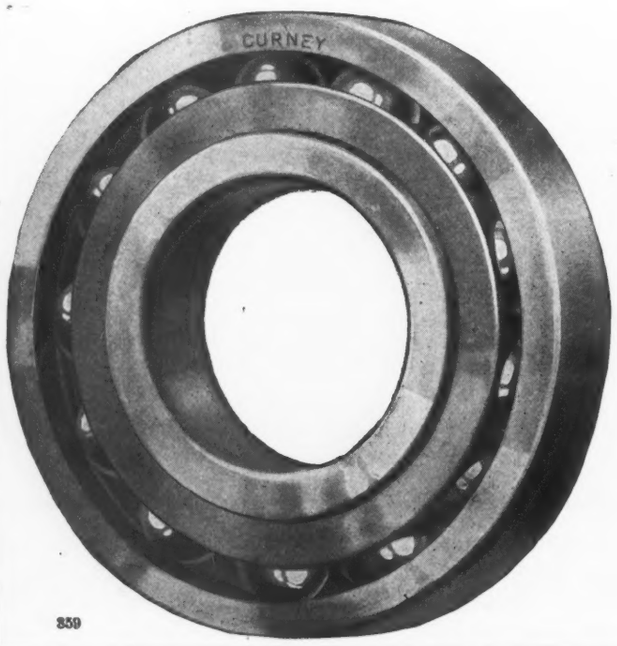
***Fully descriptive catalogs cover all "New Britain" Automatics. Let us send details of those best suited to your work.***

## COMPANY, New Britain, Conn.

# GURNEY
## BALL BEARINGS

## Their Load Capacity is Greater

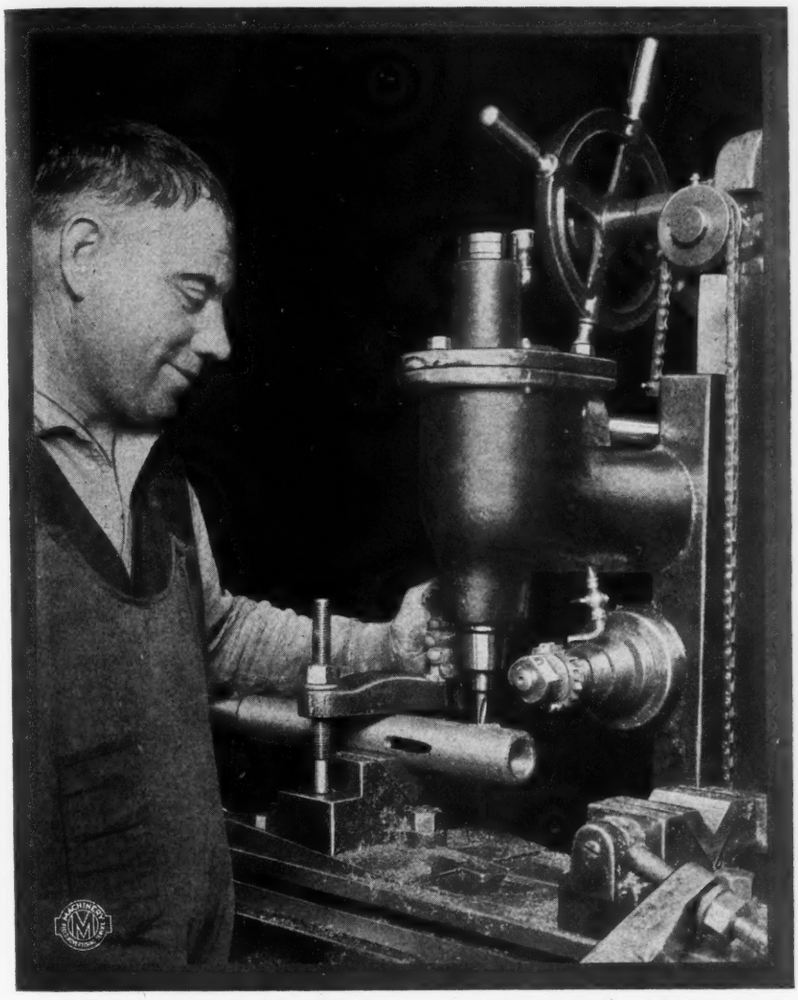
The exceptional load capacity of Gurney Bearings is due to two specific causes. By virtue of the design of the bearing and the process of assembling it, it is possible to put into it, without the use of filling slots, the maximum number of the maximum size of balls. The advantage of this is too obvious for comment. Secondly, there is realized for each ball of given size distinctly greater capacity than has heretofore been effected, by virtue of the character of the raceways that are ground in the Gurney plant. By the advances in precision which have been worked out by us and by the closer conformity of race curvature to ball curvature thus made commercially possible we have made possible and have realized a larger area of contact between ball and raceway and have thus actually gained a decided increase in ball capacity. Our bearings are listed with greater load capacity than other makes. This sometimes arouses a little skepticism. But their ratings are in reality conservative. They are accounted for by the characteristics explained above.




839

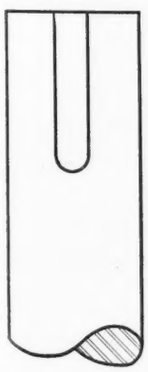
F. W. Gurney.

**Gurney Ball Bearing Co.**
Conrad Patent Licensee
Jamestown N. Y.



# *This Busy* NEWTON *Machine*

## Mills Accurate Keyseats in One Operation



This Newton Keyseat Milling Machine has been in the service of the Steinle Turret Machine Company, Madison, Wis., for over four years. The Steinle Company mills keyseats on these machines, the full width, depth and length in one operation, with the cutter on the horizontal spindle. The end mill in the vertical spindle is used only to feather or end keyseats. The table of this machine is equipped with stops to locate the work under the cutter and as no setting is required beyond clamping the work in the V-block a good rate of production is attained. This Newton Keyseat Milling Machine like all other Newton machines is "perfectly satisfactory" to its owners. Send for Catalogue No. 44 which describes this machine.

*We also manufacture Slotting Machines, Boring Machines, Cold Saw Cutting-off Machines, Rotary Planing Machines, Horizontal and Vertical Milling Machines and Portable Boring, Drilling and Milling Machines. Ask us about them.*

**NEWTON MACHINE TOOL WORKS, Inc.**

**23rd and VINE STREETS** **PHILADELPHIA, U. S. A.**

# NEWTON

# When the Question Ultimately

When you come to the consideration of the purchase of automatics the following facts may be helpful:

The number of orders we receive for repair parts is less, machine for machine, than those received for any other make of automatic. We are ready to prove that there is no make of full turret automatic that can be changed from one job to another as rapidly as the Cleveland. Cams are not removed and replaced; are simply adjusted to their drums. We were the pioneers in the manufacture of large automatics. Cleveland Automatics' capacity range is from $\frac{3}{32}$" to $7\frac{3}{4}$".

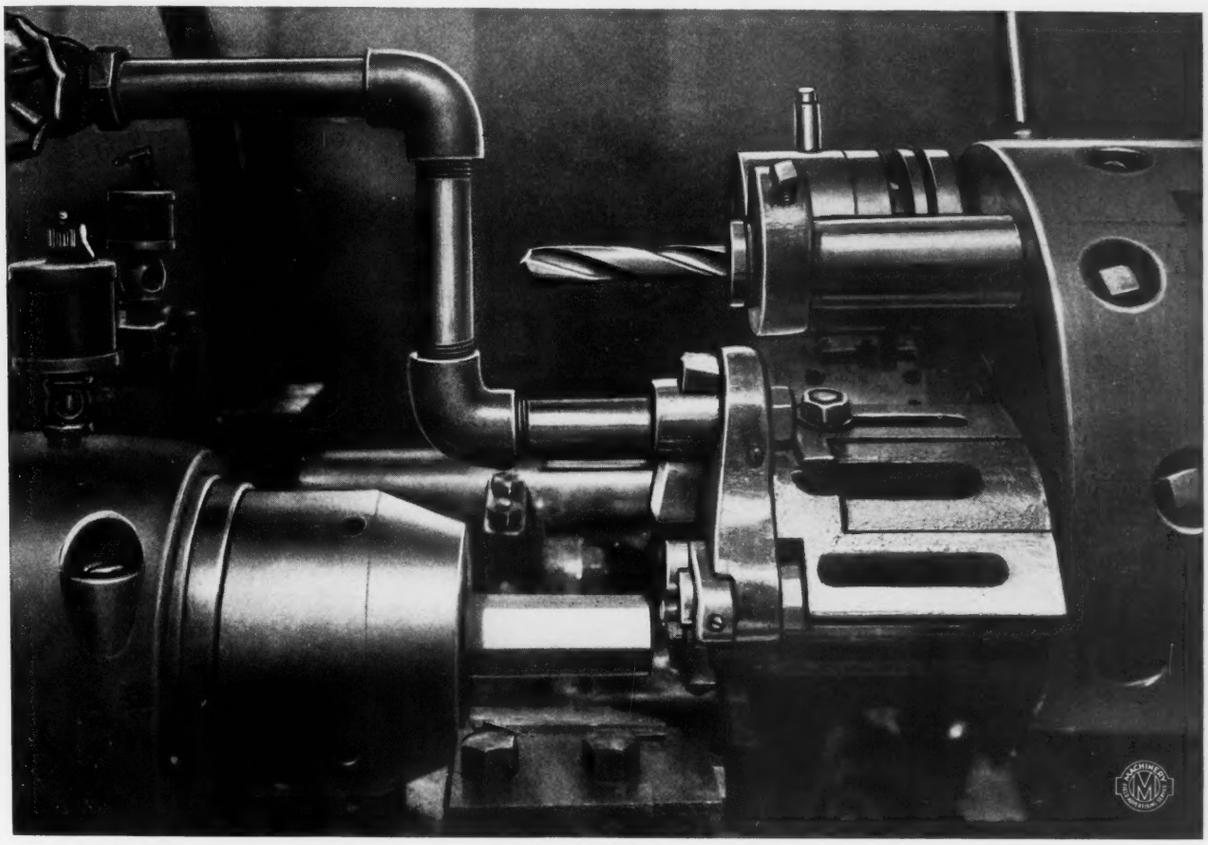
As an example of Cleveland efficiency, we have photographed the

***Many more reasons will be sent when you write***

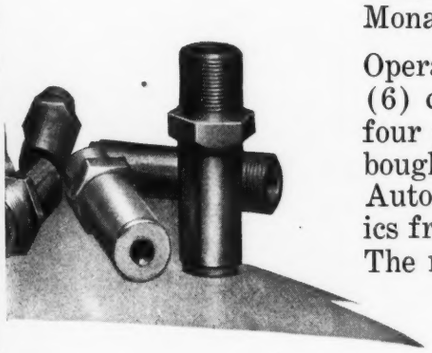
## THE CLEVELAND AUTOMATIC MACH

EASTERN REPRESENTATIVE: J. B. Anderson, 211 Gowan Ave., Mt. Airy, Washington St., Chicago. FOREIGN REPRESENTATIVES: Chas. Churchill

# CLEVELAND



# Becomes "Which Automatic?"



manufacture of boring mill pulıs at the Milwaukee plant of the Monarch Machine Co.

Operations are (1) form, (2) form, (3) drill, (4) thread, (5) ream, (6) cut-off. The two Cleveland Automatics in the Monarch plant are four years old, and have shown not the slighest change since they were bought. Durability is one of the important features of the Cleveland Automatic. We can cite hundreds of instances of Cleveland Automatics from 12 to 20 years old doing their work as satisfactorily as ever. The number of shapes that can be produced on Cleveland Automatics is infinite.

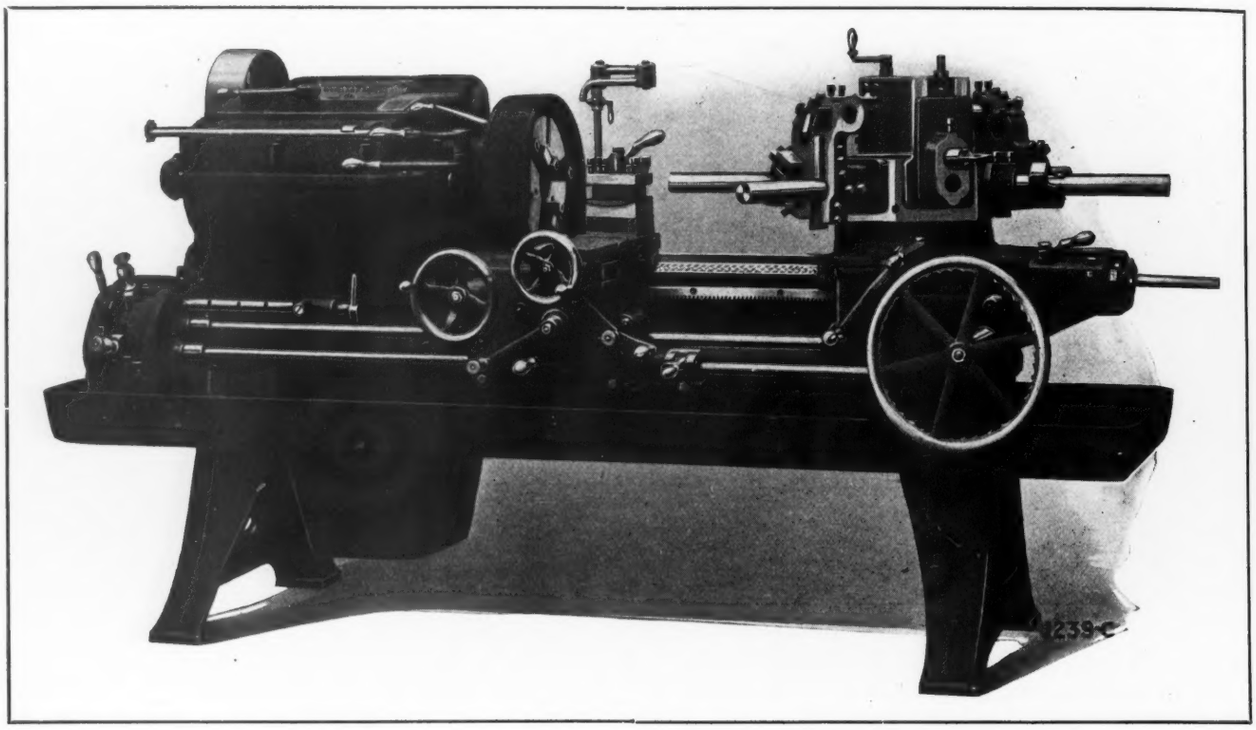
***Send blueprınts of your work for production estimates***

## INE COMPANY, Cleveland, Ohio, U. S. A.

Philadelphia. **WESTERN REPRESENTATIVE:** Herbert E. Nunn, 565 West
& Co., Ltd., London, Manchester, Birmingham, Newcastle-on-Tyne and Glasgow.

# AUTOMATICS

# W & S Turret Lathes in



**In the automobile plant, Warner & Swasey Turret Lathes are known for the satisfaction they give. They have withstood the heavy strains placed upon them during the war and now are not among the idle machines. There's a reason for this. First they hold their accuracy and efficiency, and second, they are flexible to a large number of jobs. Each of the pieces shown here is a 2-A job in some automobile plant.**

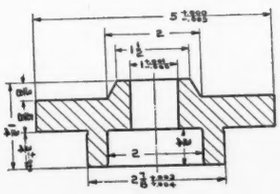
**Have you jobs like these you'd like to do faster? Send us your blue prints. Our Engineering Department will give you the benefit of their wide experience in reducing cost of production on similar parts. If it's a *new* problem it will be *more* welcome.**

# THE WARNER & SWASEY

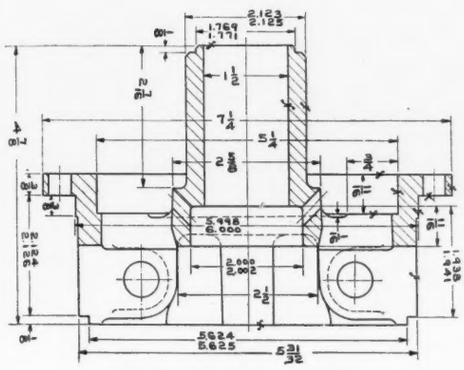
FOREIGN AGENTS: Chas. Churchill & Co.. Ltd.. London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow. Allied Mchy. Co., Paris, Turin, Barcelona, Zurich and Brussels. Van Rietschoten & Houwens, Rotterdam. Yamatake & Co., Tokyo. Benson Bros., Sydney and Melbourne. A. Asher Smith, Sydney. A. R. Williams Machinery Co., Ltd., Toronto, St. John, Winnipeg and Vancouver. Williams & Wilson, Ltd., Montreal.

# Automobile Factories

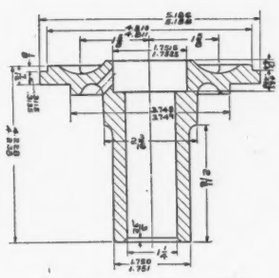
**Finished on No. 2-A's in Different Automobile Factories**



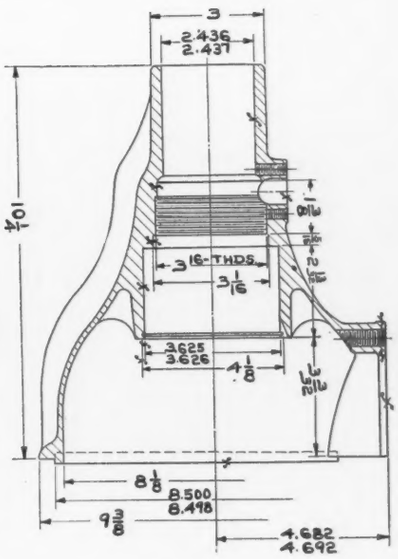
*Gear Blank*
*(Steel Forging)*



*Differential Case Side*
*(Steel)*

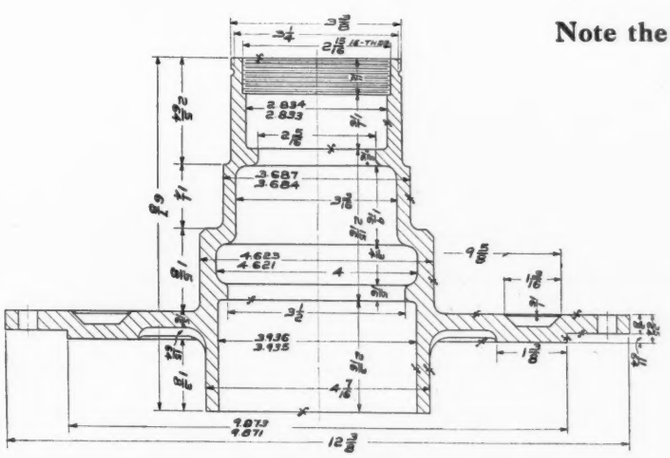


*Differential Case Side*



*Gear Case*
*(Malleable Iron)*

**Note the close limits**



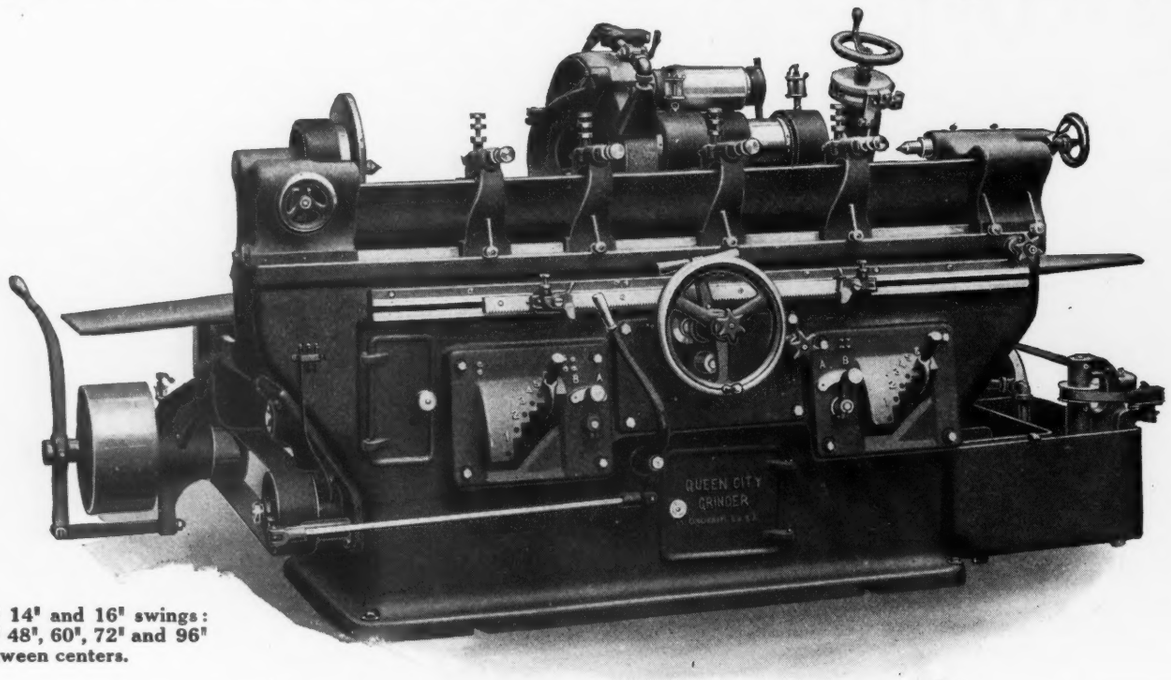
*Rear Hub*
*(Malleable Iron)*

# CO., Cleveland, Ohio, U. S. A.

New York Office—Singer Bldg. Boston Office—Oliver Bldg. Buffalo Office—Iroquois Bldg.

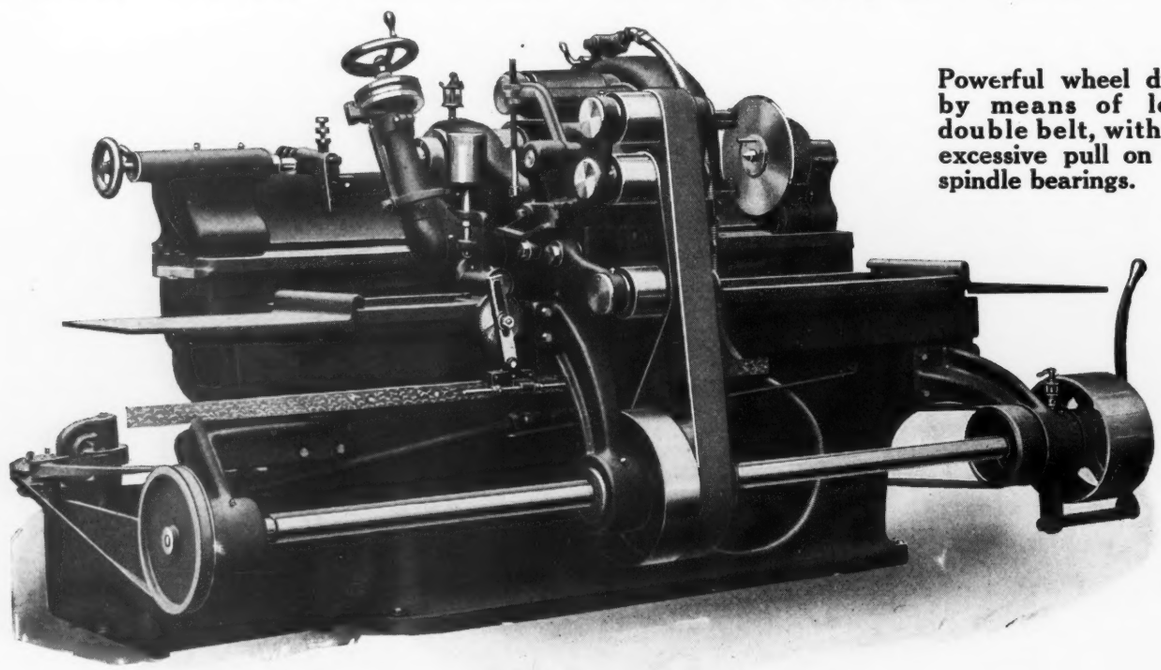
Detroit Office—Ford Bldg. Chicago Office and Show Rooms—618-622 Washington Blvd.

# QUEEN CITY Plain Cylindrical Grinding Machine




**12" 14" and 16" swings: 36" 48", 60", 72" and 96" between centers.**

Single pulley drive, (no overhead) 12 independent changes of traverse and work speeds. SKF Ball Bearing Idlers; other journals hardened and ground, with perfect lubricating facilities. Accurate—handy—durable—powerful; constant service; combines big production and commercial accuracy. Equipment for grinding crankshafts and machine with gap furnished on order.



**Powerful wheel drive by means of long double belt, without excessive pull on the spindle bearings.**

## THE QUEEN CITY MACHINE TOOL CO.

**1401-7 Sycamore Street** **CINCINNATI, OHIO**

**Manufacturers of 16-, 20-, 24- and 28-inch Back Geared Crank Shapers with many "EXCLUSIVE FEATURES" that eliminate trouble and increase production. We sell direct to user in Cincinnati district. Agents in all principal cities of the world. Send us your inquiries and you will get a square deal.**

# Another Example of Rockford Efficiency

Finishing side brackets for the Sundstrand Adding Machine, as shown by the drawing, involves finishing ten surfaces with six milling cutters. Though only one piece is finished at each pass, operating speed is such that very satisfactory production is maintained and accuracy is even closer than was anticipated. In fact, the performances of Rockford Milling Machines in the Sundstrand Adding Machine Co.'s plant are such that it is doubtful whether these people would even consider installing any other milling machines.

Rockford Millers are made in two sizes —No. 2 for heavy duty, No. 2½ for extra heavy duty. Both machines have set new records in all classes of mechanical production.

*Details and data yours for the asking.*

**Six Cutters Finishing Ten Surfaces Simultaneously**

Contour of Top of Left Side Bracket

## ROCKFORD MILLING MACHINE CO.

**ROCKFORD** **ILLINOIS, U. S. A.**

FOREIGN REPRESENTATIVES: Great Britain, A. A. Jones & Shipman, Ltd., Leicester, England. France and Belgium, Louis Besse, Paris, France. Italy and Colonies, Monti & Oscuro, Milano, Italy. Scandinavia, Ryländer & Asplund, Stockholm, Sweden, Spain and Portugal. Casamitjana Hermanos, Barcelona, Spain. Australia, Selson Engineering Co., Melbourne, Australia. Russia, M. Mett Engineering Co., Petrograd, Russia.

# "For an unusual cut, broaching is surest"

ELIMINATING the human element has proved the most successful way of assuring interchangeability of parts. No manual skill can compete in unvarying repetition with the stroke of a broach gauged to the ten-thousandth of an inch.

When the pattern calls for an unusual spline cut, or an internal eccentric curve mathematically correct to permit the proper functioning of the part, broaching makes it possible to know—before a chip falls—that the finished cut will be right. Moreover, the hundredth part will be exactly like the first, to the veriest micrometer hair line.

All the conscientious care and skill which the pride of an expert and years of experience can muster, is spent on the broach. Then the correct cut follows as a natural result —even though the broaching be done by a workman whose ability ends with the mere operation of the machine.

Broaches which can attain such accuracy are the tools produced, with just pride, by the

*J.N. LAPOINTE CO. of NEW LONDON*

2012 L

## J.N. LAPOINTE CO. of NEW LONDON, CONN.

Makers of Broaching Machines and Broaches.

# THE DILL SLOTTER

## An Essential in the Motive Power Department

Again we meet the Dill Slotter performing some essential service in a railroad shop—this time in New York State. When photographed it was slotting the tongue fit in the end of an intermediate side rod for a locomotive. These rods are vanadium steel, slotted in each end as shown in the accompanying sketch. Seven years' strenuous service leaves this 20-24 inch Dill Slotter to all intents and purposes as efficient as on the day of its installation.

***How about a Dill Slotter for your work?***

Dill Slotters are used throughout this and other lands. You will find them everywhere and the average cost of repair parts on all the machines we had out for five years did not exceed ninety cents per year.

**T. C. DILL MACHINE COMPANY**

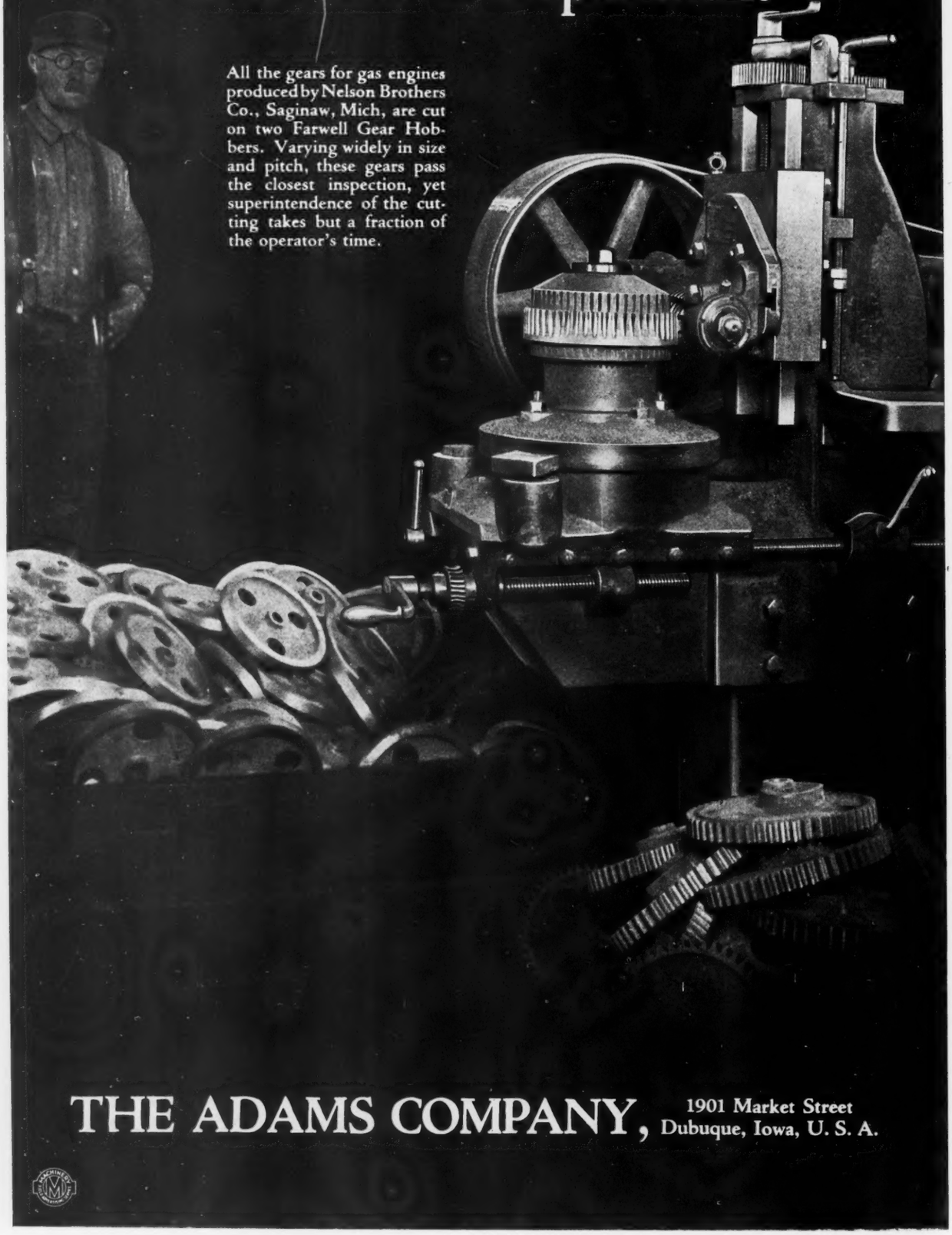
**The DILL SLOTTER PEOPLE**

**PHILADELPHIA PENNSYLVANIA, U. S. A.**

FOREIGN AGENTS: Coventry, London, Birmingham, Leeds, Manchester, Newcastle-on-Tyne and Glasgow; Alfred Herbert, Ltd. France: Societe Anonyme, Alfred Herbert, 47 Boulevard de Magenta, Paris. Italy: Societa Anonima Italiana, Alfred Herbert, 42 Via Cajazzo, Milan. Japan: Alfred Herbert, Ltd., Yokohama. Holland: R. S. Stokvis & Zonen, Ltd. Belgium: Alfred Herbert. China and Australia: Allied Machinery Co. of America.

# Two Farwell Gear Hobbers Constitute a Department

All the gears for gas engines produced by Nelson Brothers Co., Saginaw, Mich, are cut on two Farwell Gear Hobbers. Varying widely in size and pitch, these gears pass the closest inspection, yet superintendence of the cutting takes but a fraction of the operator's time.



THE ADAMS COMPANY, 1901 Market Street Dubuque, Iowa, U. S. A.

# MODERN

## SELF-OPENING

# DIE HEADS

—Because of their accuracy, dependability and durability have acquired a distinction that's unique:—

***MODERN Self-Opening Die Heads are Standard Equipment on About Nine-Tenths of the Highest Grade Turret Machines Made in America.***

The qualities which brought about this preference may well serve you in your threading problems. Merit alone caused their selection by makers who have at stake the reputation of their own products.

## FIND OUT NOW

—what they'll do for you. Modern Self-Opening Die Heads save money, save time, and save spoilage as soon as and wherever installed. Used on turret of any hand or automatic screw machine for any threading operation, and when equipped with closing device on drill press and other spindle machines. They are adjustable. "Back-off" is practically instantaneous. Chasers never touch threads after cutting. Easily cleaned. Do not clog as easily as others.

**Send for bulletin of technical details. Send us your specifications and blue prints of threading operations. You need a tool of "Modern's" exceptional qualities.**

## MODERN TOOL CO.

**Main Office and Works** **ERIE, PA.** **SECOND AND STATE STS.**

BRANCH OFFICES: New York, N. Y., 2 Rector St.; Chicago, Ill., 32 N. Clinton St.; Detroit, Mich., 40 Larned St.; Cincinnati, O., 2 Greenwood Office Exch.; Cleveland, O., Guardian Building; F. Wesley Parker, Export Agent, 2 Rector St., New York.

### OTHER "MODERN" TOOLS

"Modern" Plain Grinders, 10 sizes. "Modern" Universal Grinders. "Modern" Internal Grinders. "Modern" "Magic" Chucks. "Modern" Tapping Attachments. "Modern" Collapsible Taps.

***Send for Catalogs***

TRADE W.F. J.B. MARK

# Complete Line

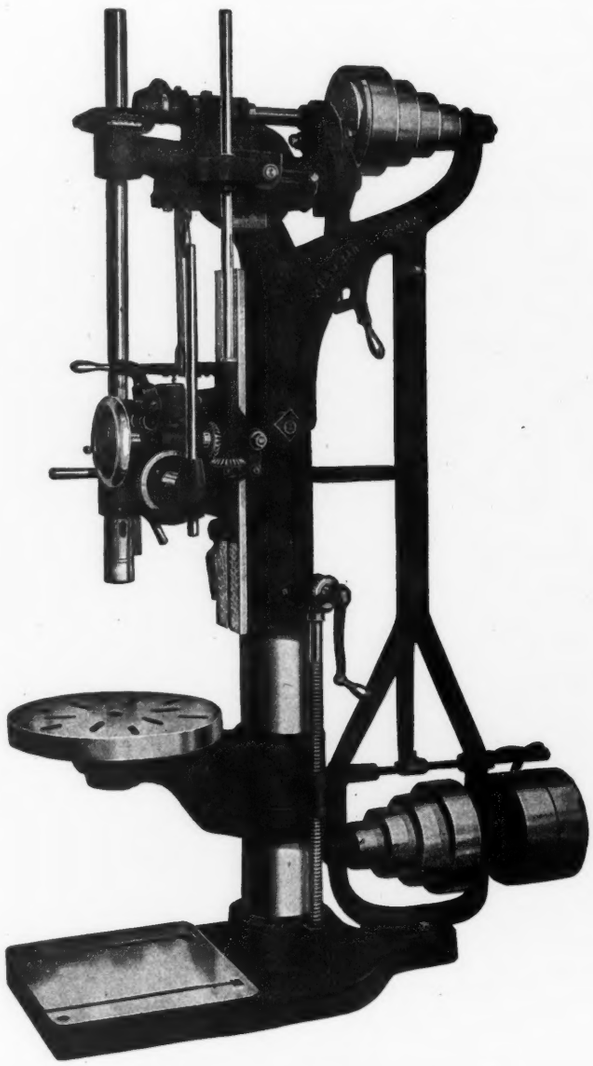
**8-inch to 50-inch Swing**

**(With or without Tapping Attachment)**

## Upright Drills

## Horizontal Drills

## Gang Drills



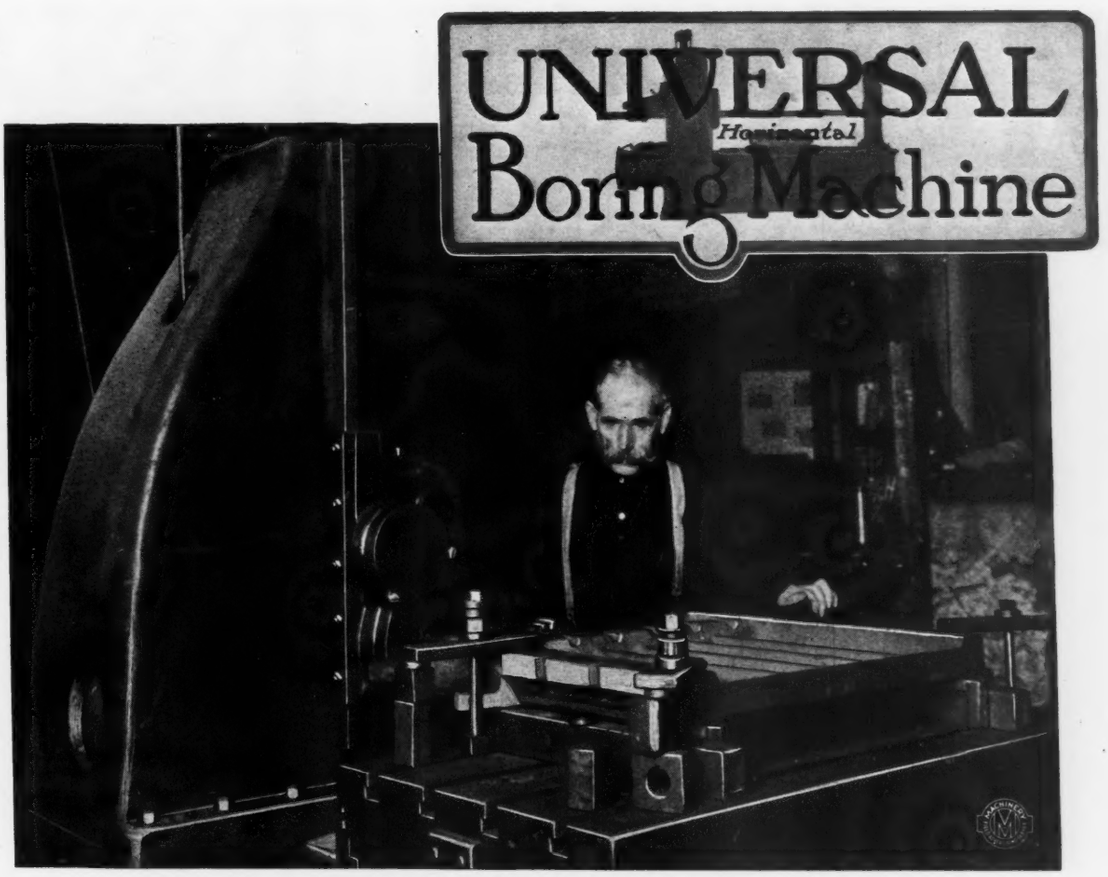
# BARNES DRILLS

**Accuracy**
**Convenience of Operation**
**Strength**

MADE BY

**W. F. & John Barnes Company**

231 Ruby Street
Rockford, Ill., U. S. A.




# SERVICE—SATISFACTION

## *The Natural Results of Choosing Right Equipment*

The Valley City Machine Company, Grand Rapids, Mich., knows machine tools. These people manufacture milling machines themselves. Before they purchase a tool, therefore, they look it over very carefully.

Two years ago they wanted a horizontal boring and milling machine. After a thorough investigation, they came to the conclusion that the Universal (Horizontal) Boring Machine would best answer their requirements.

When the accompanying photograph was taken, an order of special machines for the manufacture of drugs was going through the plant. And the Universal (Horizontal) Boring Machine got no small share of the work. The operation shown is the milling of the lower casting for one of those machines.

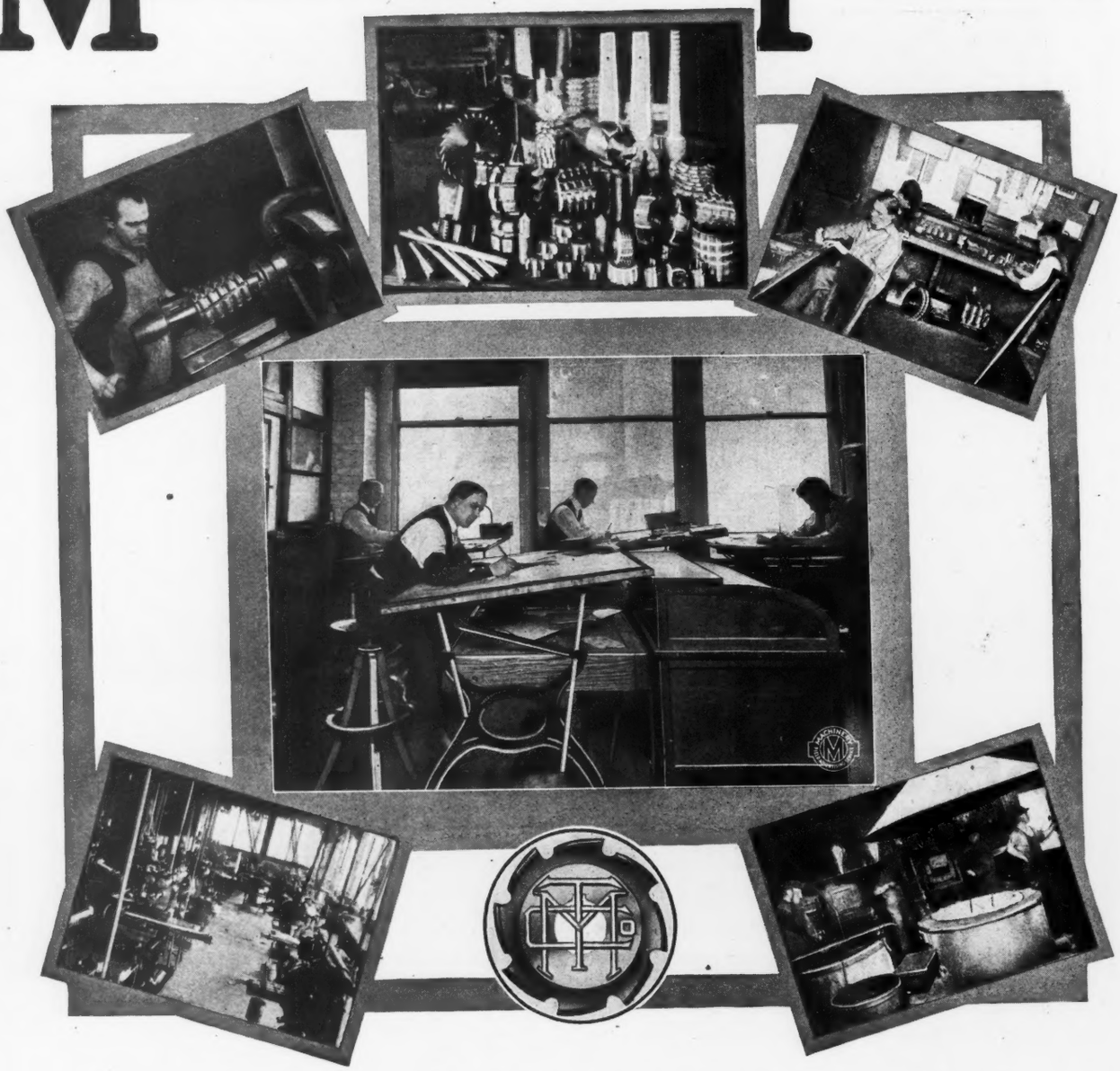
The manager of this concern says of the Universal (Horizontal) Boring Machine: "Two years of real service—no complaints of any kind."

***It will pay you to investigate the possibilities for this machine in your plant. Write us.***

## UNIVERSAL BORING MACHINE COMPANY

**HUDSON, MASSACHUSETTS, U. S. A.**

# MICHIGAN TOOLS



## Planning the Tools—Plotting the Work

We have said that our engineering service is at your command. This is so literally true that no fuller specifications for cutters, hobs, fixtures or gages are necessary than the bare statement of the "results" you wish these tools to achieve. We design tools, choose the steel and see that the treatment throughout is correct. Our engineers and our shop, work hand in hand; imbued with the Michigan idea of "super accuracy" they form an ideal organization from which to order the tools that must be right.

***Send us your specifications for estimates***

## MICHIGAN TOOL COMPANY, Detroit, Mich.

# OHIO SHAPERS

## *Meet the Most Exacting Requirements*

There is no work which demands more from a shaper than tool and die work. This was well recognized by the Steel Art Tool Co., Elgin, Ill., when they bought the "Ohio" seen in the photograph.

A 17″ cut in a folding die for sheet metal is nearing completion, and the operator is finishing up the work by hand operating the tool head. Since the parts produced by this die must not vary more than 0.0005″ from size, very close work is necessary.

The Steel Art people like Ohio Shapers. They use them on their tool and die work because they give the results they must have. "Good, rigid, adaptable machines" they call them, and that about covers all anyone requires in a shaper.

**OHIO MACHINE TOOL CO.**

***Planers and Shapers Since 1887***

**KENTON OHIO, U. S. A.**

***If you make tools you need an Ohio Shaper. Ask for details***

**DISTRIBUTING AGENTS**

Pittsburgh, Laughlin-Barney Mchy. Company; Cleveland, W. M. Pattison Supply Company; Chicago, Dale-Brewster Mchy. Co.; Philadelphia and Baltimore, Monarch Machinery Company; Toledo, Coghlin Machinery and Supply Company; New York City, Garvin Mch. Company; Providence, Brownell Mchy. Company; Hartford, Purinton & Smith Mchy. Company; Syracuse, H. A. Smith Company; Grand Rapids, McMullen Machinery Company; Detroit, English & Miller Company; St. Louis, Colcord-Wright Machinery and Supply Company; Indianapolis, Vonnegut Machinery Company; Boston, Factory and Mills Supply Company; San Francisco, General Machinery & Supply Co.; New Orleans, P. H. McArdle; Portlan, Ore., Pacific Engineering and Equipment Company; Tacoma, Sterling Machinery Company; Los Angeles, Shaw-Palmer-Bakewell Company; Omaha, Sunderland Machinery Company; Minneapolis, Gunther-Plant Company; Salt Lake City, American Machinery Company; Milwaukee, Badger-Packard Mchy. Co.

GODDARD TOOL COMPANY
Chicago Detroit
STANDARD STOCKS CARRIED BY
Dale-Brewster Machinery Co., Inc., New York and Chicago
Branch Office, Philadelphia Bourse, Philadelphia, Pa.

# This Set of Slocomb Micrometers is in Great Demand

Photographed by courtesy of the Central Machine & Tool Company of Toledo, Ohio — specialists on fine tool and die work.

SLOCOMB MICROMETERS ARE ACCURATE REG. U.S. PAT. OFFICE

# Slocomb Micrometer

## "the longest lived Micrometer that can be bought"

Nearly every man in this shop owns Slocomb Micrometers. Nevertheless, this set is in constant demand for measuring the larger diameters, as practically every dimension here is held to extremely close limits.

Slocomb Micrometers are practical equipment for any shop—accurate, durable and sufficiently rugged to stand hard service. Their distinctive advantages are fully detailed in Catalog 16, which describes also our new "Quantity Production Micrometer." Write for your copy today.

## J. T. Slocomb Company

PROVIDENCE R. I., U. S. A.

FOREIGN AGENTS: England: Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow. Japan: Alfred Herbert, Ltd., Yokohama. Italy: Chas. Civita, Milan. Australia: Edwin Wood, Pty., Ltd., Melbourne and Sydney.

# HAMILTON PLANERS

Rapid Production HAMILTON Machine Tools

## The Question of Cost

The picture illustrates an interesting set-up of the Hamilton Planer in a large Ohio manufacturing plant. Two 8-foot and four 6-foot lathe beds are mounted on the Hamilton; bottoms, sides and vees to be rough and finish planed.

The entire series of operations is performed in 30 hours. Planing the side, by the way, includes the planing of the channel at the headstock end.

In considering the question of cost, this company was attracted to the Hamilton Planer by its many economical features.

Driving gears have been quadrupled and the driving mechanism made exceptionally heavy. Bearing surfaces are scraped to precision. Speed, accuracy and rigidity are fully assured.

**There's a HAMILTON Agent in or near your town. Let him help you figure your costs**

## THE HAMILTON MACHINE TOOL CO.

**HAMILTON** **OHIO, U. S. A.**

DOMESTIC AGENTS: Machineshop Equipment Corp'n, Boston, Mass. Machine Tool Engineering Co., New York. Syracuse Supply Co., Rochester, N. Y., Syracuse, N. Y., Buffalo, N. Y. Sherritt & Stoer Co., Inc., Philadelphia, Pa. J. S. Miller Machinery Co., (Planers), Pittsburgh, Pa. Cooperative Machinery Co., Cleveland, O. Osborne & Sexton Machinery Co., Columbus, O. Wolverine Machinery & Supply Co., Detroit, Mich. Stocker-Rumely-Wachs Co., Chicago, Ill. Thomson Tool & Supply Co., Indianapolis, Ind. W. C. Johnson & Sons Mchy. Co., St. Louis, Mo. F. E. Satterlee Co., Minneapolis, Minn. Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo. Herberts Machinery & Supply Co., San Francisco, Cal., Los Angeles, Cal. M. J. Walsh Mchy. Co., Milwaukee, Wis. Textile Mill Supply Co., Charlotte, N. C. General Fire Extinguisher Co., Atlanta, Ga. Oliver H. Van Horn, Inc., New Orleans, La. CANADIAN AGENTS: H. W. Petrie, Ltd., Toronto, Ont., Canada.

# The ROULSTED IS A Versatile Lathe

## This Concern Knows It

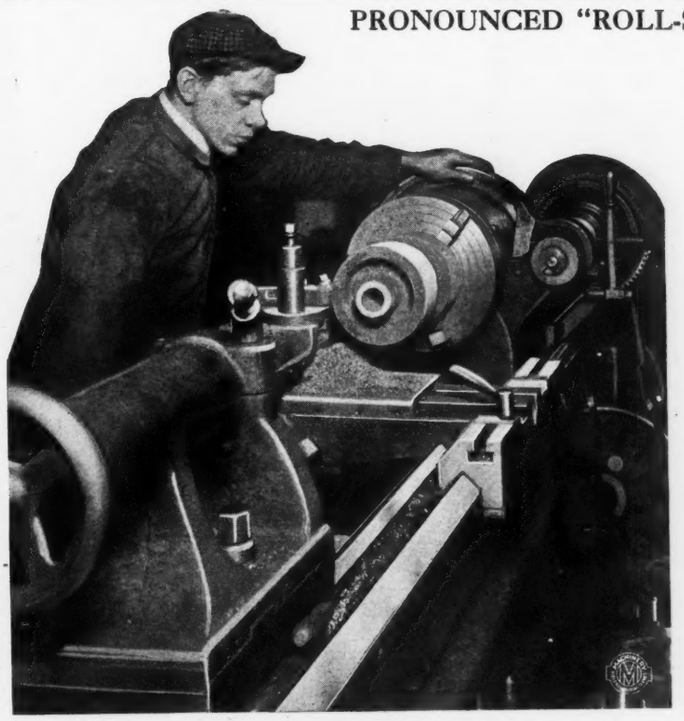
Tools, dies, gages, jigs, fixtures, special machinery and parts, ship and engine work and a line of lathe chucks are all turned in the Roulsted Lathe where these photographs were taken.

A varied line demands a versatile machine. This concern chose the Roulsted. Many a job in this plant requires genuine pulling power.

If you would see the Roulsted "dig in" on this kind of work you'd have no further doubts as to the lathe for your work.

# THE ROULSTED TWENTY

PRONOUNCED "ROLL-STED"



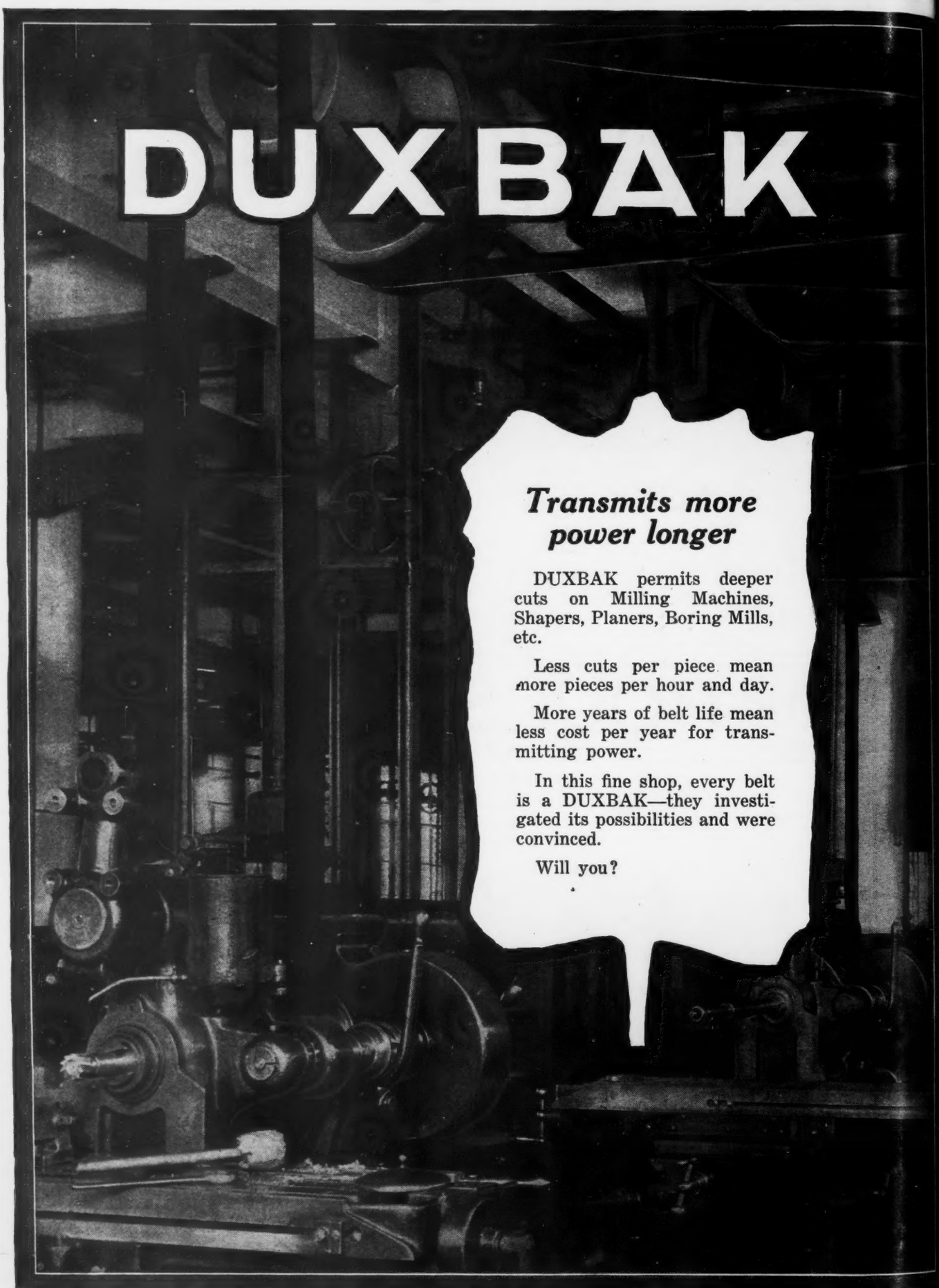
The Roulsted Twenty is accurate, fast and easy to operate. It swings 21″ over bed, 14″ over carriage, 8″ over steadyrest. It has a 2 1/16″ hole through the spindle and carries a 4″ belt. Spindle speeds range from 7 to 285 R.P.M.

*We'll gladly send production records and other facts. Write.*

## Hill, Clarke & Company, Inc.

**The Machinery Merchants**

156 Oliver St., Boston, Mass.
136 Cedar St., New York City


DUXBAK
Transmits more power longer
DUXBAK permits deeper cuts on Milling Machines, Shapers, Planers, Boring Mills, etc.
Less cuts per piece mean more pieces per hour and day.
More years of belt life mean less cost per year for transmitting power.
In this fine shop, every belt is a DUXBAK—they investigated its possibilities and were convinced.
Will you?

# Belting Tests

Tests conducted over long periods of time at the Mellon Institute of Industrial Research of the University of Pittsburgh, with belts which are listed below, show the following definitely established and proven results:—

**(Belts used:—First Grade Single Leather, Single Solid Woven Cotton, 4-ply Rubber, 4-ply Canvas, and 4-ply Balata, all 4-inches wide, run over pulleys of 24-inches diameter at 500 R.P.M., or 3140 Feet per Minute, at the manufacturers own specified tension).**

**SLIP**—Leather showed a perfect curve of slippage, but at a 40-horsepower load it was only approximately 3 per cent. On the other hand, Solid Woven Cotton Belting could not be made to transmit more than 22 horsepower at which point the slip curve flattened out, and this was the best record shown by any of the substitute materials.

**EFFECTIVE PULL**—The maximum effective pull of belts per square inch of cross-section, belt speed 3140 feet per minute was proven to be as represented by the following numerals: 1st Grade Single Leather, 100; Single Solid Woven Cotton, 77; Four-Ply Balata, 47; Four-Ply Rubber, 25; and Four-Ply Canvas, 20.

The effective pull of the various materials may be further accentuated by the fact that the leather belt, in these tests, required a speed of but 490 F.P.M. to give 1 H.P. per inch of width as against 760 F.P.M. for the best performance of any of the substitutes.

Perhaps you would like to read our latest booklet, "The STORY of SCHIEREN BELTINGS"—sent free for the asking, and well worth the while of any man interested in transmitting power. Address the office nearest you.

***Main Office and Factory*—73 Ferry St., NEW YORK, U.S.A.**

**OAK LEATHER TANNERIES, BRISTOL, TENN.**

**Branch Houses**

Atlanta, Ga., 190 Marietta St.
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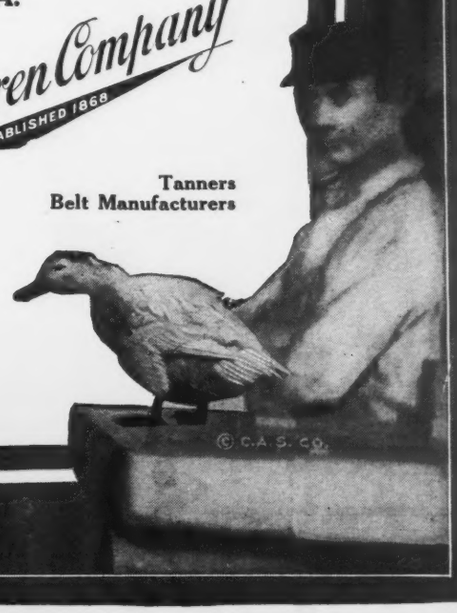
Cleveland, 777 Rockwell Ave.
Kansas City, 1324 West 12th St.
Philadelphia, 226 N. Third St.
Pittsburgh, 337 2nd Ave.
Memphis, Tenn., 477 So. Main St.
Milwaukee, Wis., 212 Sycamore St.
St. Louis, 10th and No. Market Sts.
Salt Lake City, Dooly Bldg.
Seattle, 305 First Ave., So.
The Texas Chas. A. Schieren Co., Inc., Murray & Williams Sts., Dallas, Tex.

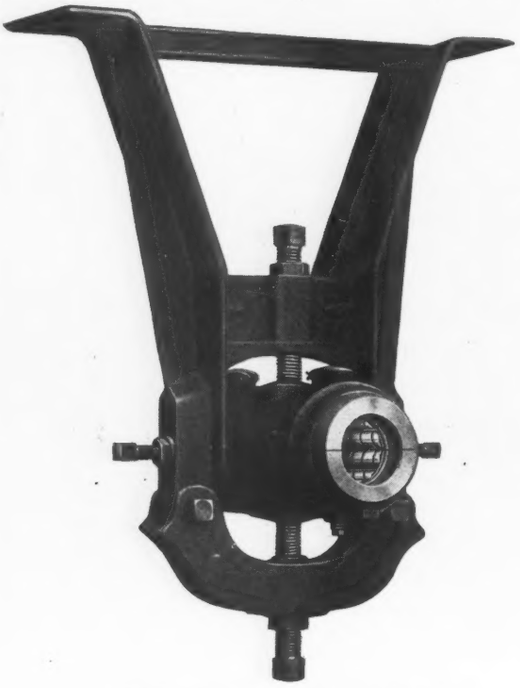
Chas. A. Schieren Company
ESTABLISHED 1868

**Tanners**
**Belt Manufacturers**




XBAR BELTING
TRADE MARK
Reg. U.S. Pat. Off.

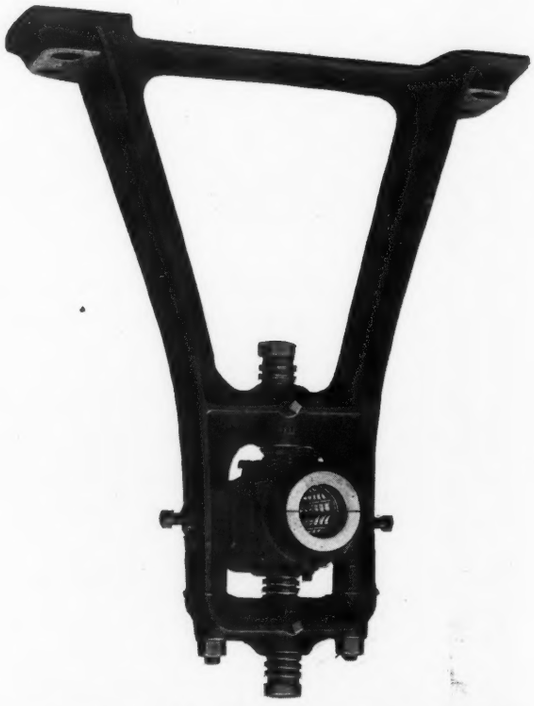
# WHAT TYPE OF HANGER



PIONEER STEEL FRAME

UNIVERSAL GIANT (U. G.) FRAME

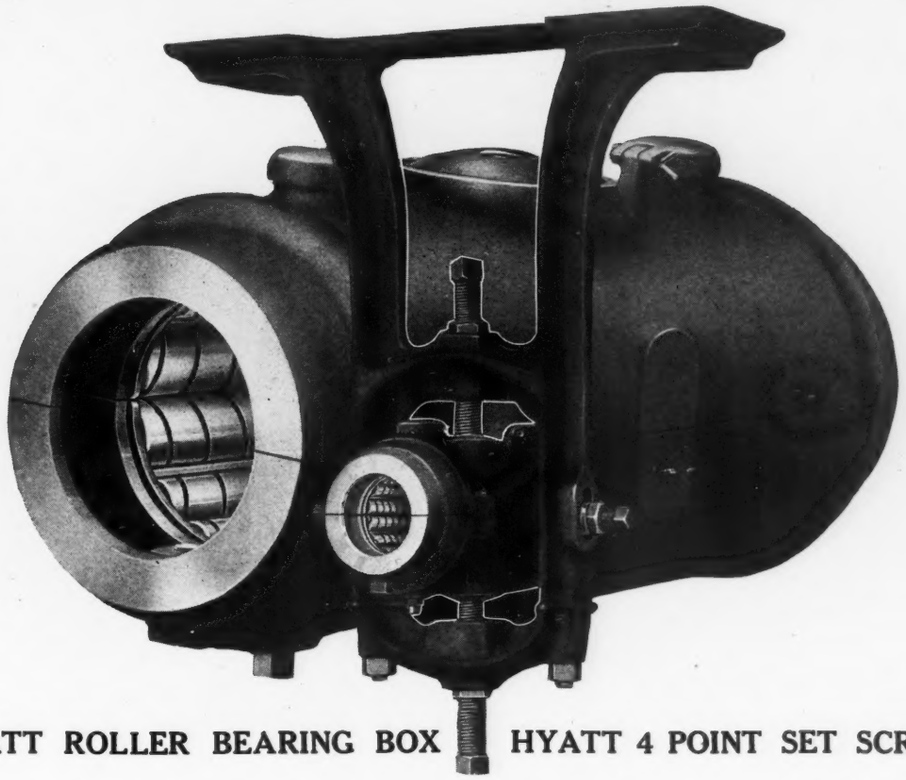
J-FRAME



BALL & SOCKET (B. & S.) FRAME

# HYATT BEARINGS

# FRAME DO YOU USE?



THE HYATT ROLLER BEARING BOX | HYATT 4 POINT SET SCREW FRAME

Hyatt Roller Bearing line shaft boxes can be supplied to the following types of frames:

1. **4 Point Set Screw Frame**
2. **Pioneer Steel Frame**
3. **Universal Giant (U. G.) Frame**
4. **Ball and Socket (B. & S.) Frame**
5. **J-Type Frame**

No elaborate and expensive change-overs are necessary therefore, in order to obtain the many advantages of Hyatt Roller Bearing Hangers.

Any millwright can apply Hyatt Roller Bearing boxes to these types of frames. He simply takes out the old babbitted bearings and puts in the Hyatt Roller Bearing box which is split in two sections throughout—the pulleys, collars and couplings on the shaft do not have to be disturbed.

This points to a simple and inexpensive way of obtaining Standardized Transmission Equipment. Standardization gives maximum production at minimum cost.

Our transmission data will be of value and interest to you. Send for it today.

B-114

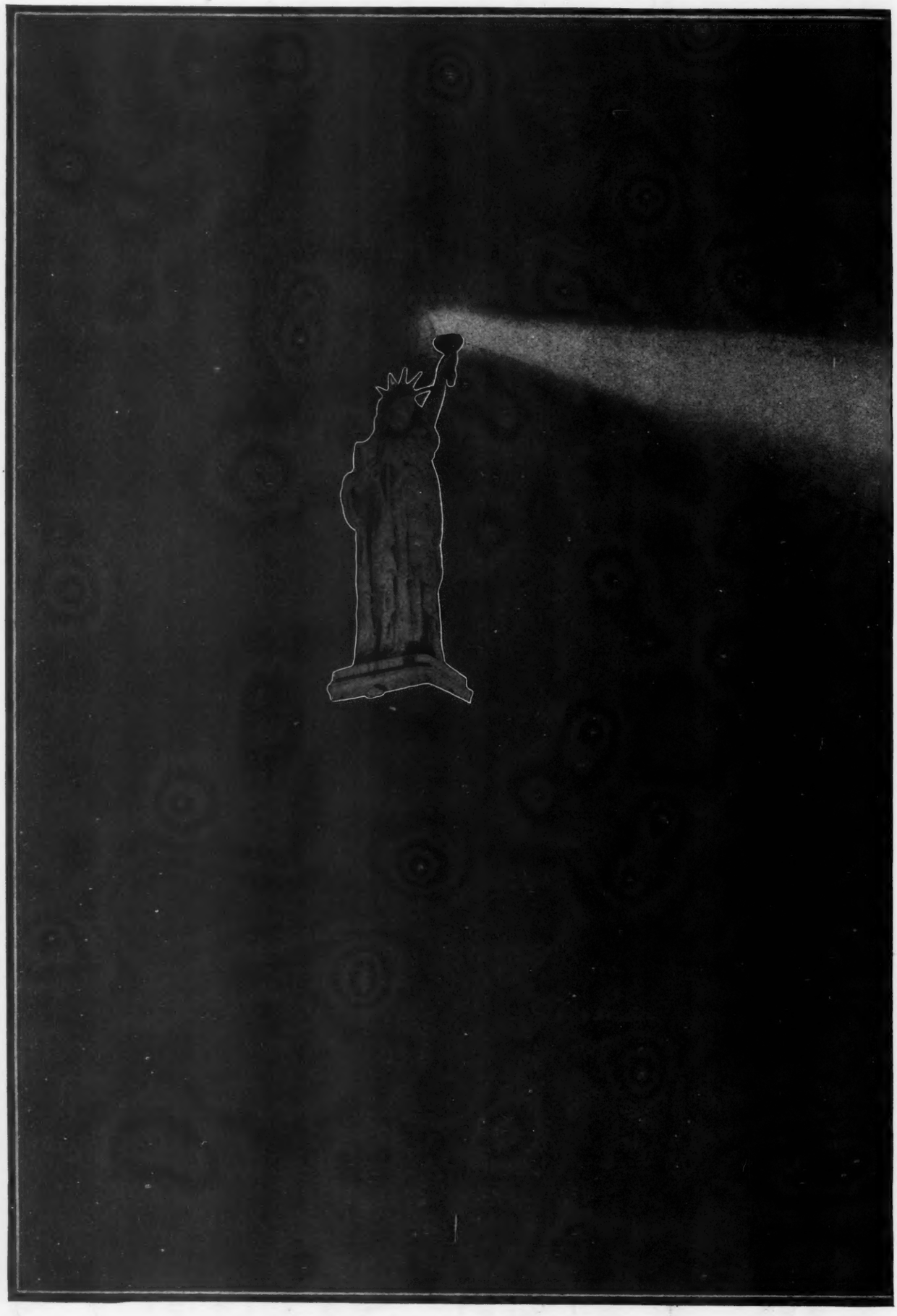
MOTOR BEARINGS DIVISION
DETROIT, MICHIGAN

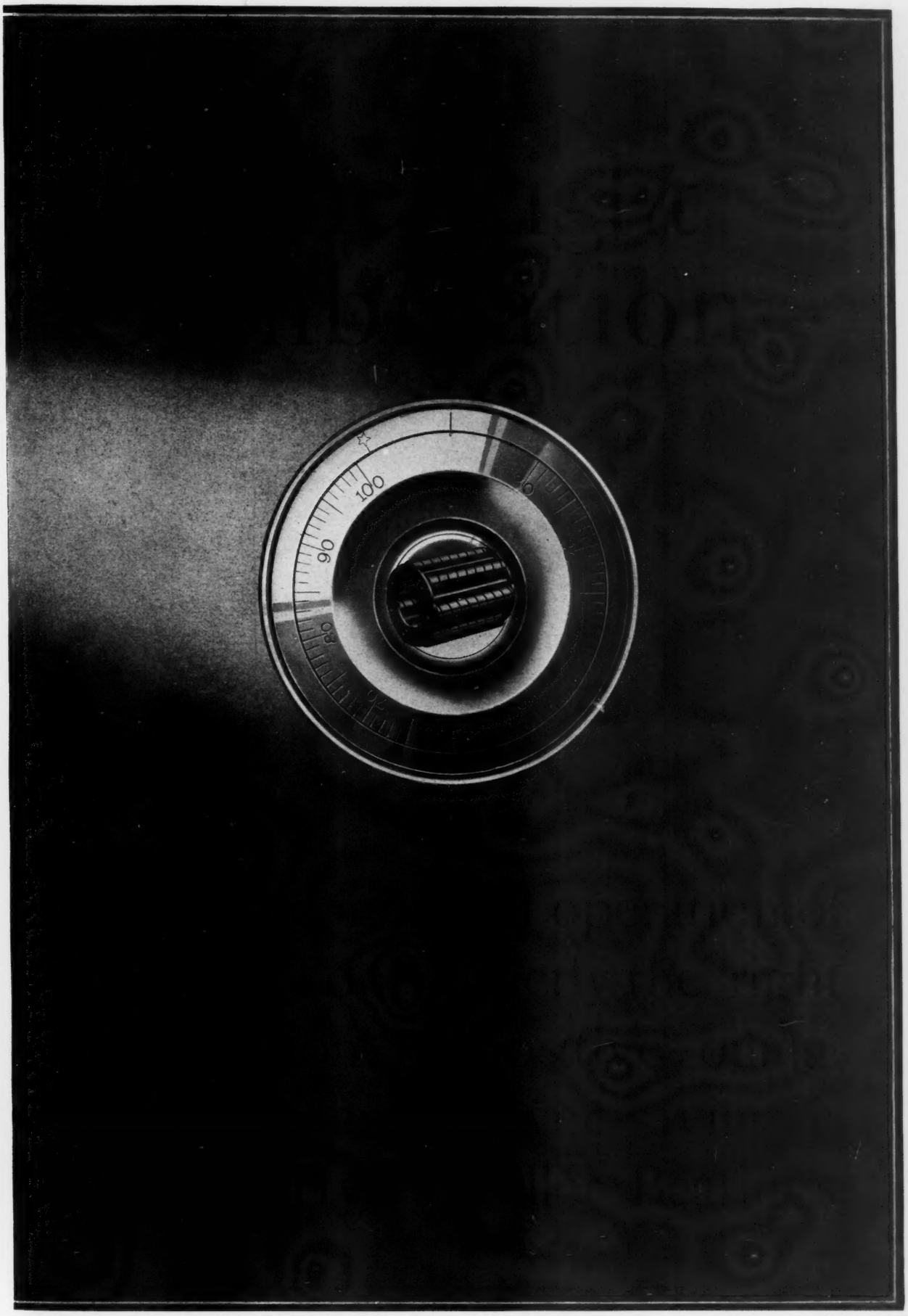
**HYATT ROLLER BEARING COMPANY**
**INDUSTRIAL BEARINGS DIVISION**
**METROPOLITAN TOWER, NEW YORK**

TRACTOR BEARINGS DIVISION
CHICAGO, ILLINOIS

***Manufacturers of Bearings for Mine Cars, Ore Cars, Steel Mill Cars, Roller Tables, Trolleys, Cranes, Hoists, Machine Tools, Line Shafts, Countershafts, Concrete Machinery, Textile Machinery, Conveyors, Lift Trucks, Industrial Trucks, Railway Service Cars, Storage Battery Locomotives, etc.***

# FOR LINE SHAFTS




100
90
80

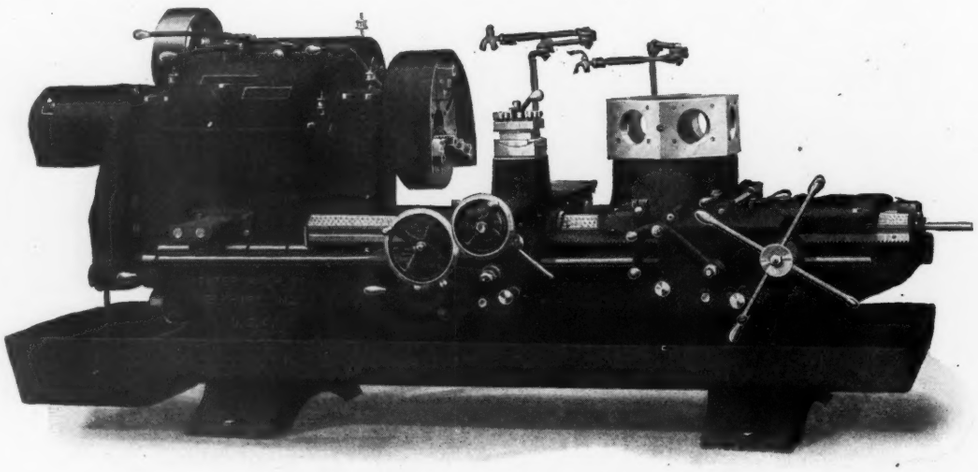
# Foster 3-B Universal Turret Lathe

The problem of increased production is the motive force back of all development in machine tools. Human labor is becoming increasingly more expensive, yet more and more work has to be produced. Machine tools, therefore, must be made increasingly more efficient and thus capable of producing a larger quantity of work at a lower cost per piece.

The 3-B Universal Turret Lathe which was announced in the July issue of MACHINERY has been designed with these problems in mind. Back of it are years of study and designing experience, a modern and well equipped factory, a highly skilled manufacturing organization and the Foster guarantee and service.

## Head

An abundance of power is delivered to the work by the All Geared Head. The 18" diameter pulley and 5" wide belt are capable of delivering in excess of ten H. P. at the spindle nose. The large diameter friction for starting, stopping and reversing is capable of transmitting even more power than can be delivered to same from the belt. The large friction surface insures against undue wear which is synonymous with a long life.



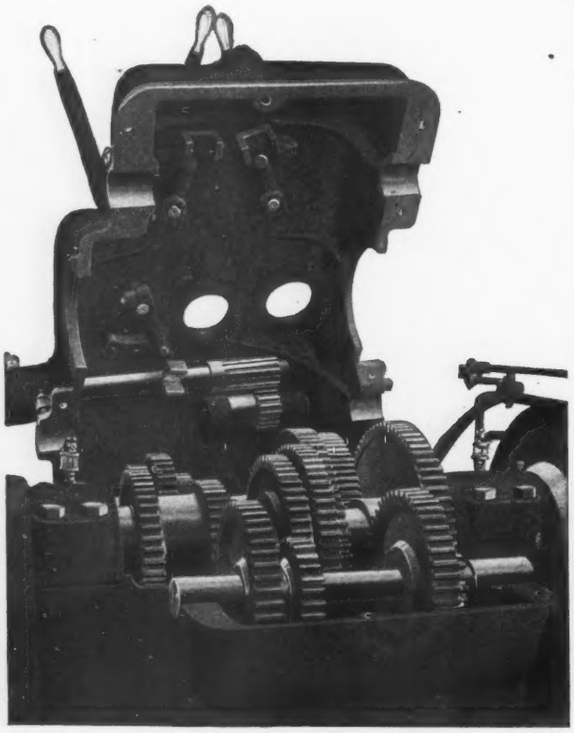
3-B UNIVERSAL TURRET LATHE WITH SCROLL CHUCK

The twelve speed changes forward and reverse ranging in geometrical progression from 8 to 217 R.P.M. are obtainable by sliding gears. These gears are made of high grade steel forgings and are carefully carbonized and heat treated. The spindle is of hammered forging of high carbon steel. The gears are running in a bath of oil.

The system of control approaches the ideal very closely. The levers for obtaining the various speed changes and for operating the stop, start and reverse friction are all located on top of the head within easy reach of the operator. The value of the time saving feature involved in this ideal system of control can hardly be overestimated.

The elimination of overhang in machine tools is important. The various chucks used for bar work forgings and castings are rigidly mounted on the spindle nose in a manner to obtain the minimum of overhang and thus secure the maximum of rigidity.

The bearings throughout the head are of a special composition bearing bronze specially well adapted for this class of machine tools.



INTERIOR VIEW OF HEAD

## Bed

The bed is designed throughout with the problem in mind of making it as rigid a support as possible for the work and tool carrying units. The head is, therefore, cast integral with the bed. The wide span of the ways insures a rigid support for the carriage and saddle under all cutting conditions. The heavy ribbed box construction has resulted in exceptional rigidity throughout without the use of an unduly large amount of cast iron.

## Square Turret, Cross Slide and Carriage

The convenience of the control is a pre-eminent feature in the design of this unit. Of the twelve feed changes in either direction, six changes and reverse are obtainable in the apron itself. The feeds range, for the longitudinal movement, from .0055 to .150 and for the cross slide .0028 to .080. The longitudinal feeds are engaged and disengaged by the drop-out lever. Six independently adjustable stops, mounted on the carriage, provide automatic means for this engagement of the longitudinal feed at any predetermined point in accordance with the requirements of the work.

The cross feed screw has mounted on same a large graduated dial on which adjustable observation stops are provided. The power feed for the cross motion is controlled by a hand operated friction clutch.

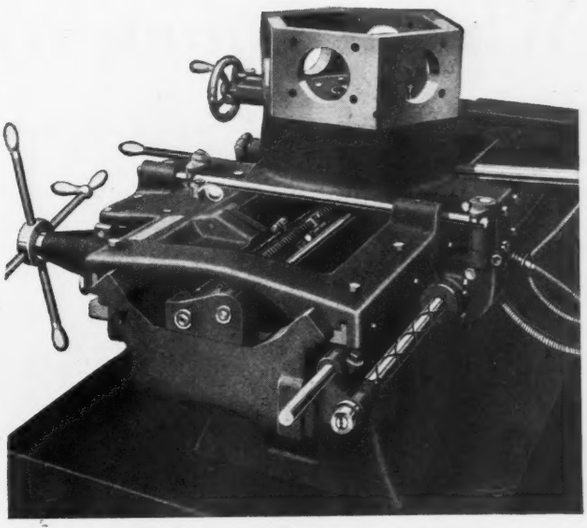
The square turret is controlled by a lever mounted on top of same. It is firmly located in any one of its four positions by a vertical lock bolt working into a taper bushing underneath the corner of the square turret. The table on the rear of the cross slide provides a place for mounting special or standard tools such as wide forming tool holders, multiple necking tool holders, etc.

The driving pinion and feed changing gears in the apron are made of alloy steel and carefully heat treated. The gears run in a bath of oil.

## The Hexagon Turret and Saddle

The hollow hexagon form of turret possesses advantages not found in either the solid hexagon or the flat type of turret, due to the fact that the heads of the screws securing the tools to the turret are on the inside of the turret wall, which means a shorter overhang and a corresponding increase in the rigidity of the tools of same.

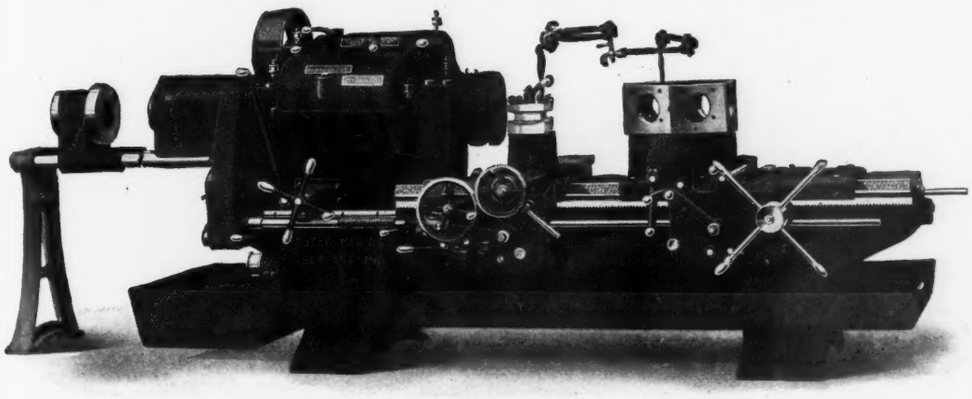
The turret faces are surfaced after the machine is assembled by means of a single pointed cutter held in a swing tool on the spindle. This method assures that the turret faces are absolutely square with the center line of the spindle. The turret holes are also bored in place to bring about a perfect alignment of same with the spindle.



HEXAGON TURRET AND SADDLE

The vertical lock bolt which serves for registering and locking the turret is located directly underneath the working tool. It is withdrawn by means of a hand lever conveniently placed on the front side of the saddle. Part of the movement of this same lever is utilized for binding the turret securely to the saddle.

Of the twelve feed changes ranging from .0055 to .150 six are obtainable in the apron. The drop out lever engages and disengages the power feed. The forward feed movement may be arrested at any predetermined point by adjustable dogs mounted on the top spool located between the ways of the bed. The stop dog screw is brought into contact with the stop on the saddle as it moves forward. A slight longitudinal movement of this stop is transmitted to a plunger in the drop out lever causing the disengagement of power feed. The stop roll which is long enough to accommodate the total efficient travel of the saddle is geared to the turret and registers automatically with same.

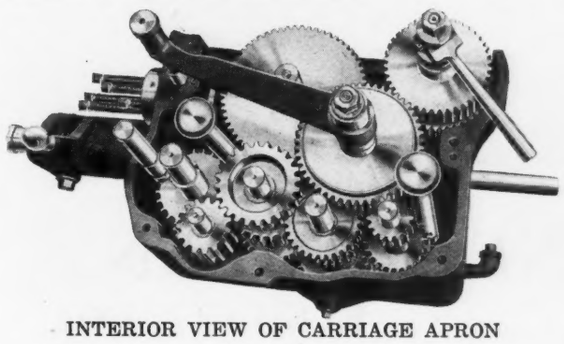


NO. 3-B UNIVERSAL TURRET LATHE WITH AUTOMATIC CHUCK AND BAR FEED

The powerful rapid traverse mechanism mounted on the rear side of the saddle is controlled by a conveniently located lever within easy reach of the operator. The rod mounted immediately above the rapid traverse screw provides means for arresting the forward movement of the saddle at any predetermined point. The forward movement of the saddle is stopped immediately as the operator releases the pressure on the control lever. This prevents accidently running the tools into the work. The turret lathe, however, is efficient only when efficiently tooled. The standard equipment of tools and attachments that can be furnished with this machine is of the same high quality as the machine itself.

To obtain the lowest possible cost of production on parts manufactured in large quantities special tools are frequently required.

We have a staff of turret lathe experts and highly skilled tool designers thoroughly capable of solving the production problems put before them.



INTERIOR VIEW OF CARRIAGE APRON

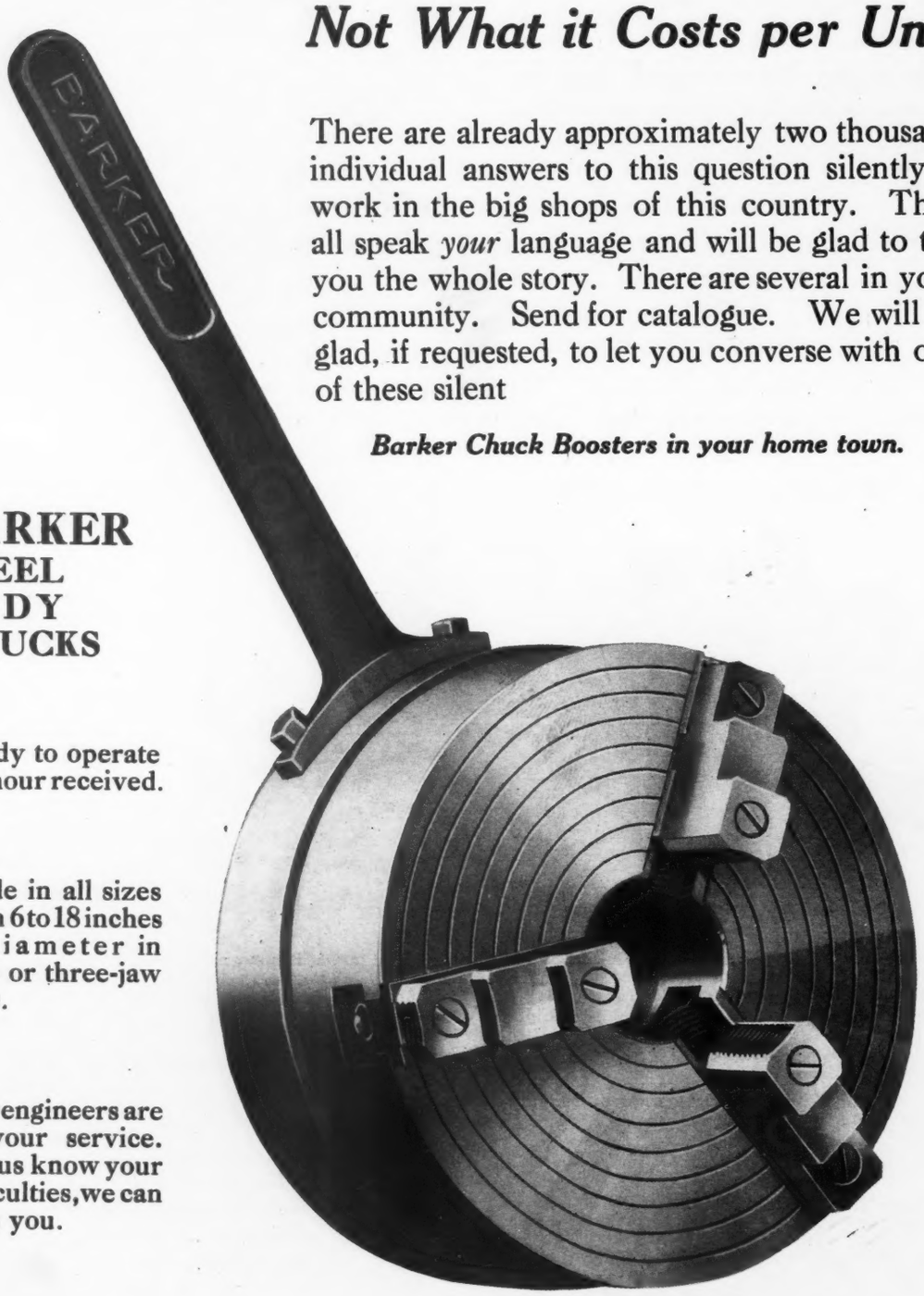
*Mail us your blue prints and let our engineers study your production problems and show you what this new machine is capable of doing on your particular work.*

# Foster Machine Co.

## ELKHART, INDIANA, U. S. A.

# What a Chuck Will Do Per Dollar Is the Question—

## *Not What it Costs per Unit*




There are already approximately two thousand individual answers to this question silently at work in the big shops of this country. They all speak *your* language and will be glad to tell you the whole story. There are several in your community. Send for catalogue. We will be glad, if requested, to let you converse with one of these silent

***Barker Chuck Boosters in your home town.***

**BARKER**
**STEEL**
**BODY**
**CHUCKS**

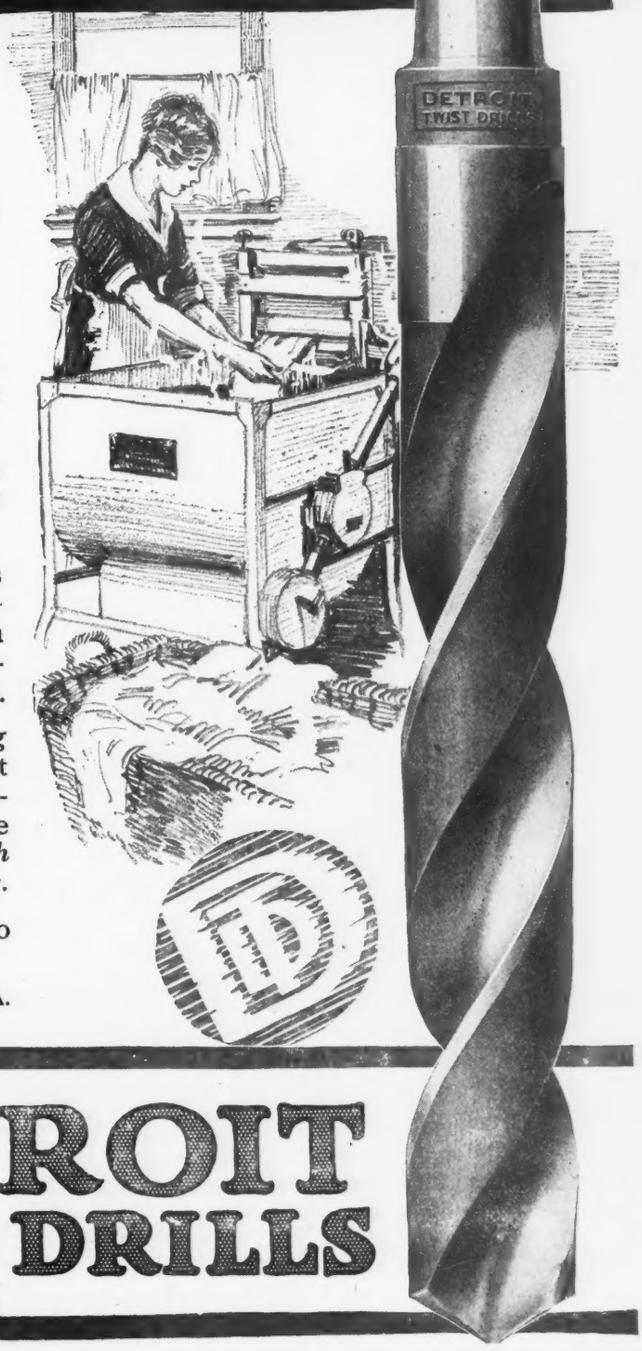
Ready to operate the hour received.

Made in all sizes from 6 to 18 inches in diameter in two- or three-jaw type.

Our engineers are at your service. Let us know your difficulties, we can help you.

## FOSTER MACHINE COMPANY

**Chuck Department** **ELKHART, IND.**




# Quick Accurate Holes

***to Make Monday Morning Pleasant for the American Housewife***

Nowadays Mrs. America touches a button and *Presto*—the automatic electric washer cleans her clothes and her linens.

But how could the maker have put the washer together without the aid of *accurate holes?*

Here is another illustration of the tremendous importance of the quick precise twist drill—of the fact that Detroit Twist Drills serve you by serving well the manufacturers who supply you with utilities of your everyday life.

In the household specialty field the leading manufacturers standardize on Detroit Twist Drills for the same reason that they are specified in other metal working lines—because they produce *truer, quicker holes, with less regrinding, and less cost for power.*

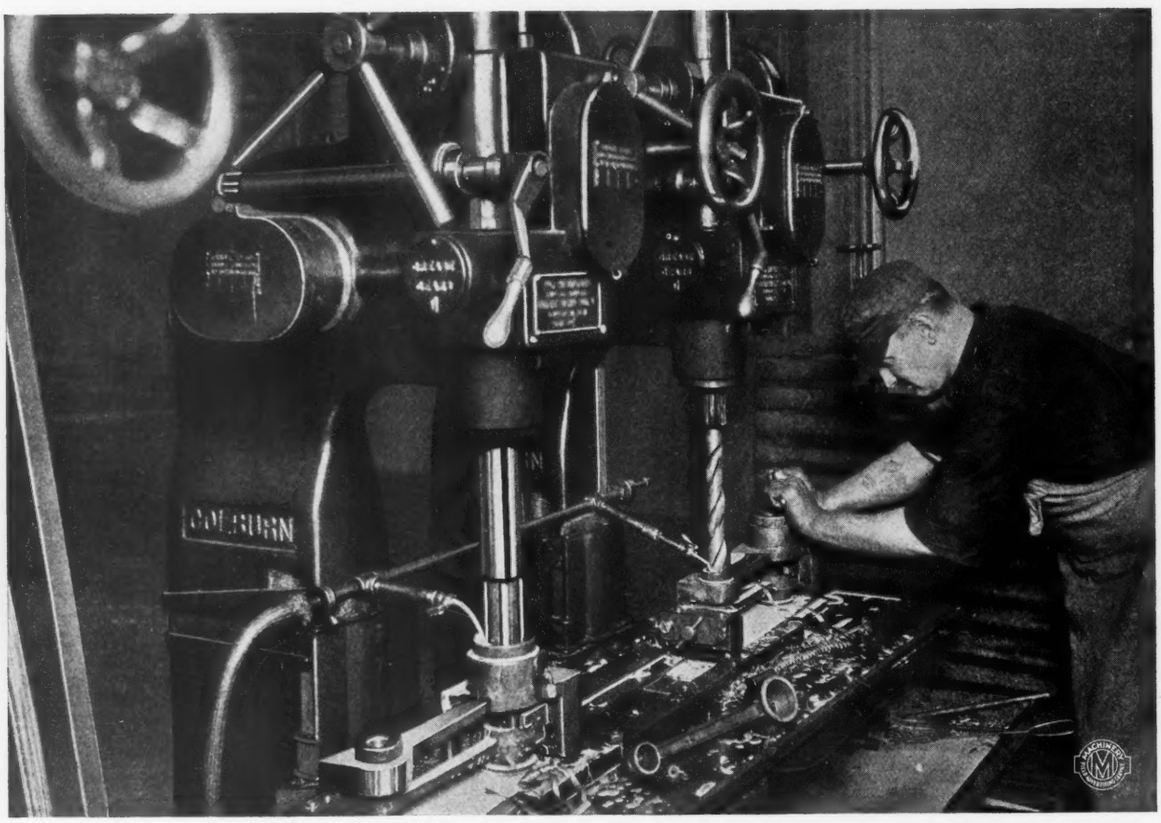
In buying your own drills remember to specify DTD.

DETROIT TWIST DRILL COMPANY, DETROIT, U. S. A.

Determination of Percentage of Carbon in Steel

# DETROIT TWIST DRILLS

# COLBURN




## Team Work With Colburn No. 2 Manufacturing Drills

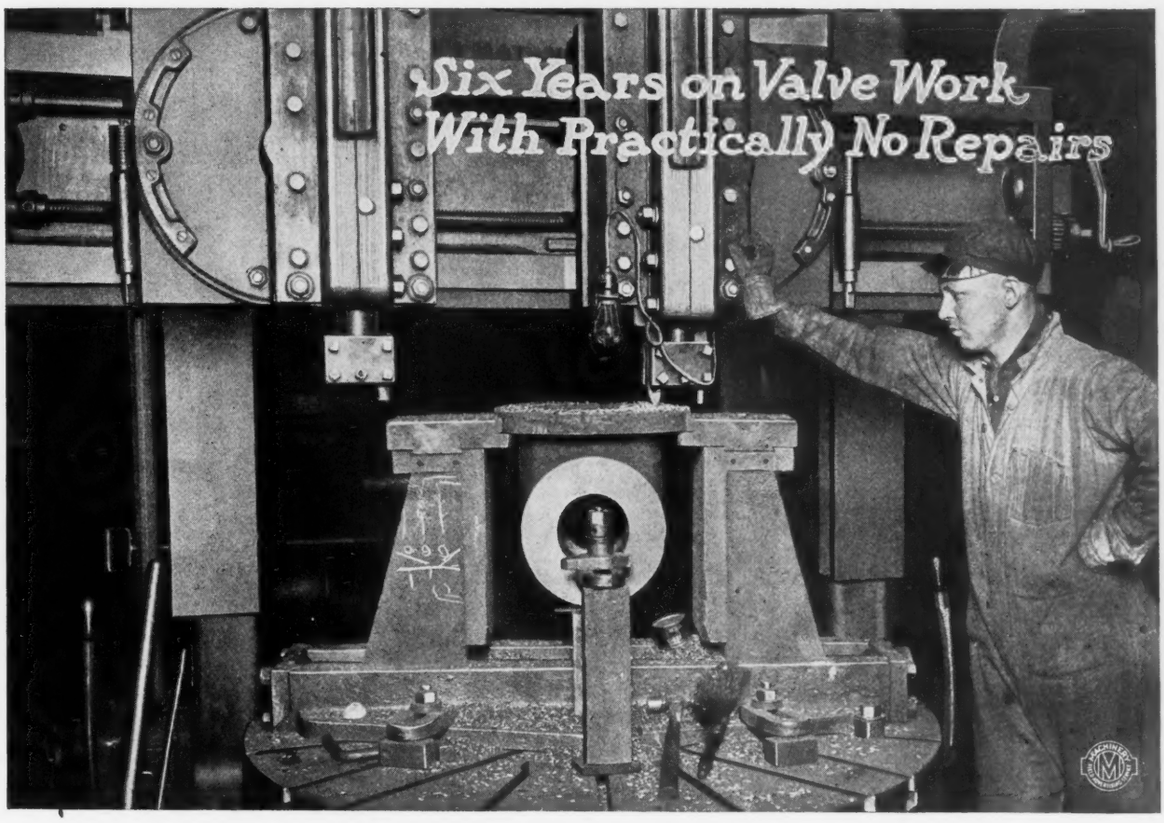
These two Colburn Drills are tied together by a supplementary one-piece table with tracks extending its entire length. The work is drop forged connecting rods, chucked in a special jig which slides along the tracks. At the first spindle, a hole 1 11/32″ is drilled through 1½″ of solid metal; the second machine bores a hole 2⅛″ in diameter through the 2″ boss—removing an average of 5/16″ on a side. Production is uniform throughout a 10 hour day—25 rods, 50 holes, per hour.

***Three of these machines have been used for four years in the Fruchey Machine Co's. shops, at Detroit, Mich., and they are better satisfied with them every day.***

## COLBURN MACHINE TOOL

**Builders of Heavy Duty Drill Presses**

# COLBURN




## A 60-Inch Colburn Vertical Boring and Turning Mill

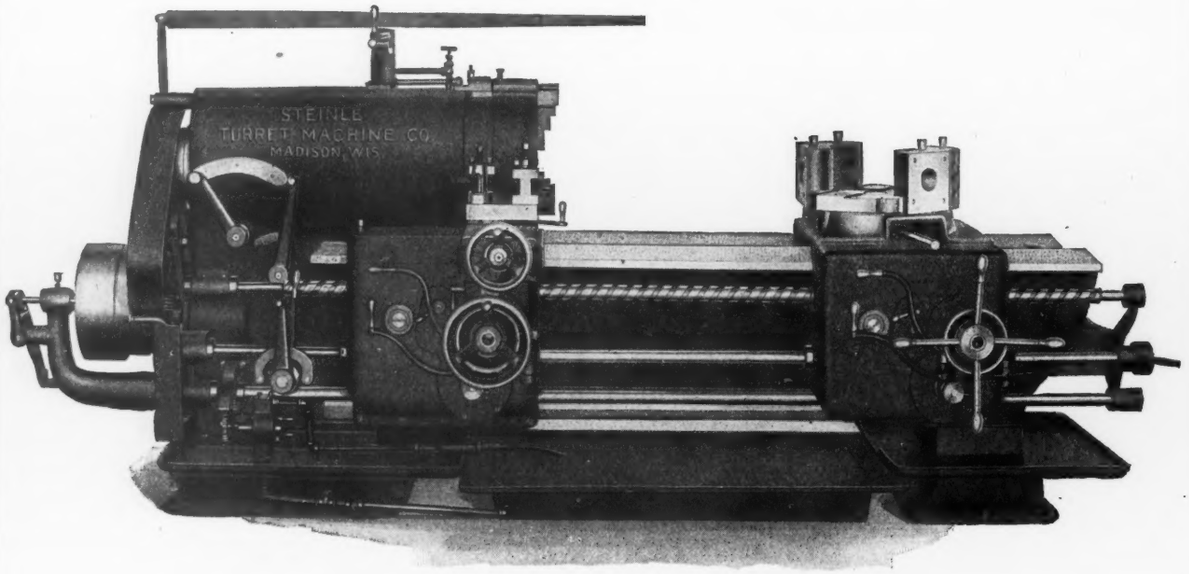
Heavy cuts on surfaces far above the table are characteristic of valve work—this Colburn Mill's principal assignment in the Pittsburgh (Pa.) Valve Foundry & Construction Co's. shop. In this case the fixture raises the surface even higher than usual.

There are three steps to the operation—a very heavy roughing cut; a finishing cut across the face; and a small counterbore turned in the center. Time to complete—34 minutes.

***Let us send the catalog of Colburn machines—you'll find in it figures for some interesting comparisons.***

**COMPANY, Franklin, Pa., U. S. A.**
**and Vertical Boring and Turning Mills**

# STEINLE




Five reasons why the Steinle 24″ Full Swing Side Carriage Turret Lathe is ahead of all others in the economical and accurate production of many classes of work:

**The Constant Power Single Pulley Drive.**

**The Massive High Powered Quick Change Speed Headstock.**

**The One Piece Box Construction Design of Bed and Headstock Housing.**

**The Side Carriage.**

**The Combination Turret.**

We are going to tell you more reasons.

Would you like a bound set including January, February, March, April, May, June and July advertisements of the Steinle 24″ Full Swing Side Carriage Turret Lathe describing the above mentioned features as they appeared in this journal? We shall be glad to furnish same on request.

## STEINLE TURRET MACHINE CO.

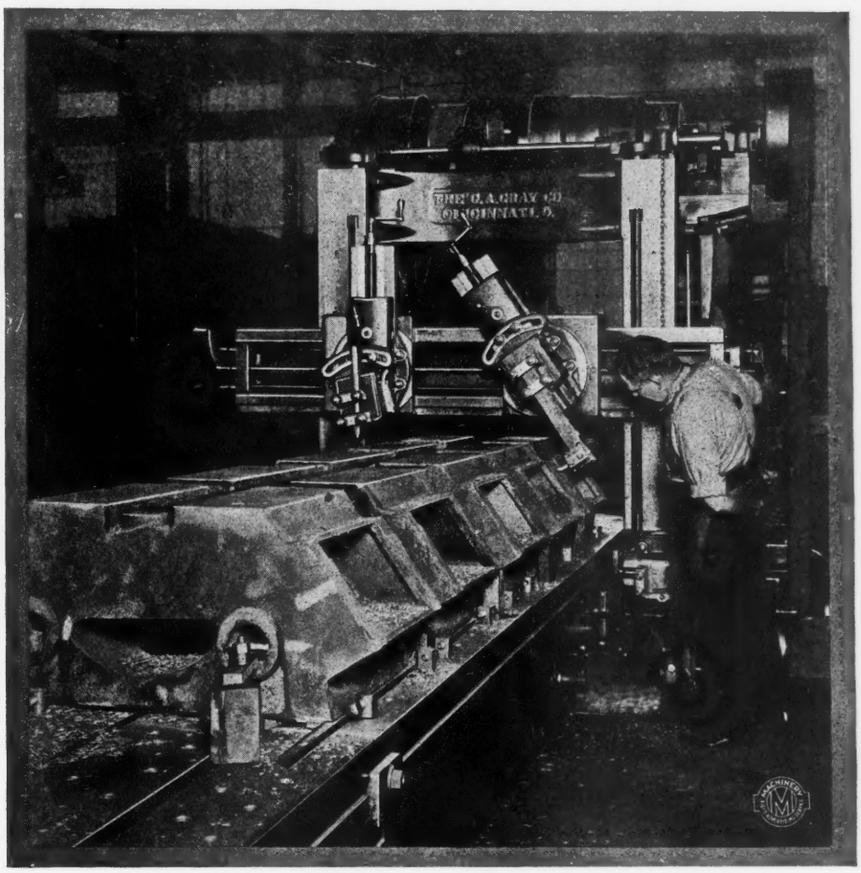
**MADISON** **WISCONSIN, U. S. A.**

Eastern Representative: Machine Tool Engineering Co., Singer Bldg., 149 Broadway, New York.

Detroit Representative: Cadillac Tool Co., Dodge-Power Bldg., 268 Jefferson Ave., Detroit, Mich.

Pacific Coast Representative: L. G. Henes, 75 Fremont St., San Francisco, Cal., and Title Insurance Bldg., Los Angeles, Cal.

# Gray Planers



## Deep Cuts and Fine Finish Both Obtained with the Gray Planer

"Other factors being equal, what casts the deciding vote in favor of Gray Planers?" An interesting question this—its answer brings out a distinguishing characteristic of all work coming from this machine.

"Because it planes surfaces so smooth, and with such a high quality of finish, that much of the hand scraping otherwise necessary is done away with."

Photograph shows a Gray Planer in operation at the plant of the Landis Machine Co., Waynesboro, Pa., the five iron castings on table being headstocks for this company's double head threading machine. Top and bottom measurements approximate 22″ square, and angular surface 22″ x 10″. Floor to floor time 20 hours. The castings weigh 1,000 lbs. each.

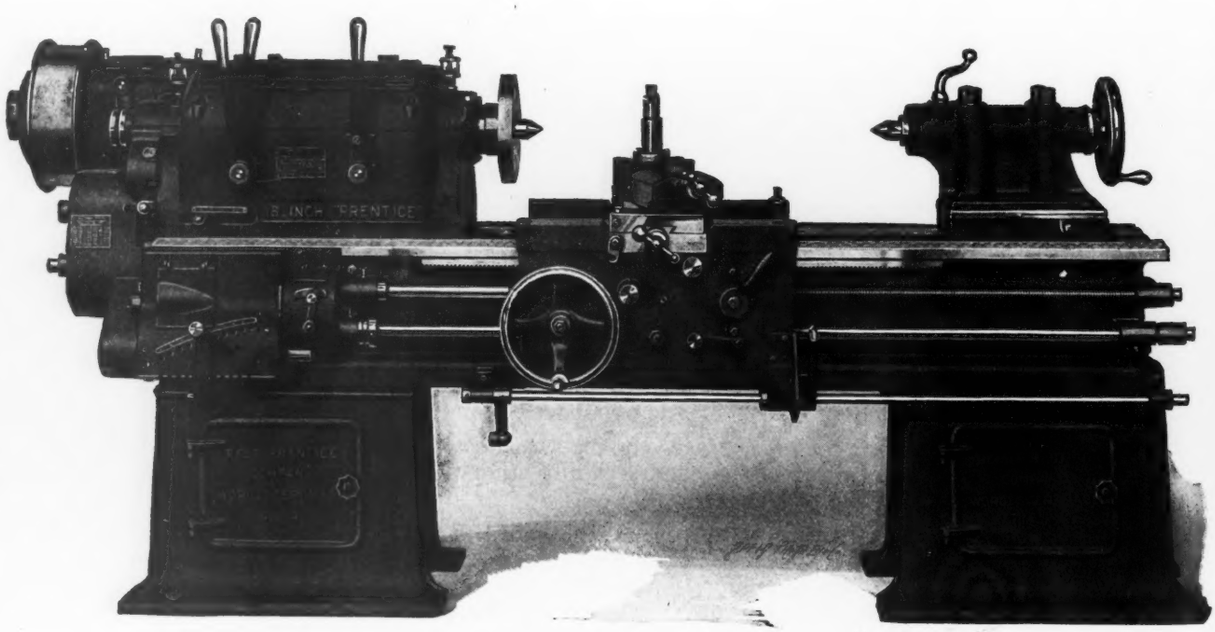
*A postal will bring catalog.*

## THE G. A. GRAY COMPANY

CINCINNATI OHIO, U. S. A.

# REED-PRENTICE COMPANY

WORCESTER MASS. U.S.A.



REED-PRENTICE COMPANY

WORCESTER MASS. U.S.A.

## USEFULNESS

ALL THINGS ARE JUDGED BY THEIR USEFULNESS. THE DEGREE OF THEIR USEFULNESS IS DETERMINED BY COMPARISON WITH THE ARTICLE, METHOD OR MANNER FORMERLY EXPERIENCED OR USED.

COMPARISONS ARE NOT INVIDIOUS BUT ARE NECESSARY TO DETERMINE USEFULNESS SCIENTIFICALLY.

THE USEFULNESS OF REED-PRENTICE MACHINE TOOLS IS IN PROPORTION TO THE INCREASED PRODUCTION THEY WILL GIVE YOU IN YOUR SHOP.

WE WOULD LIKE TO SHOW YOU WHY YOU MAY EXPECT GREATER USEFULNESS FROM A "PRENTICE" GEARED HEAD LATHE. MAY WE HAVE THIS PRIVILEGE?

MANNING, MAXWELL & MOORE, INC.
CANADIAN FAIRBANKS-MORSE CO., LTD.
FENWICK FRERES.

# Williams' "Agrippa" Rigid—Spring Threading-Tool Holder

## *A Paradox*

A "PARADOX," says that garrulous old gentleman of dictionary fame, Mr. Noah Webster, is "any phenomenon * * * with seemingly contradictory qualities." It's a rare bird and does not nest in every bush, but we have one—a fine specimen—the best of its kind in captivity. We call it the Williams' "Agrippa" Threading-Tool Holder and it is so designed as to be capable of altering its character in the twinkling of an eye, almost; that's where the "Agrippa" beats the field. The Lock-Bolt and Nut for the Lockable-Spring Head, shown separately in the illustration, provide for the absolutely rigid backing required for coarse threading and heavy cuts; loosen the Nut, and the Holder becomes a "goose-neck" spring-tool for fine threading and finishing work.

And there you are—two tools in one, at the price of one, each perfectly adapted to absolutely contradictory requirements—it's truly a paradox. To its paradoxical features is added the advantage of ability to change its character as desired, by a mere twist of the wrist, without disturbing the setting of the tool-post or tool. It's so perfectly simple, it's simply perfect.

Machinists' Tool Booklets on request.

P.S.—Williams' "Agrippa" Tool Holders are furnished in a wide range of sizes for all regular machining operations: Turning, Planing, Boring, Knurling, Cutting-Off and Side Work.

**J. H. Williams & Co.**

**"The Drop-Forging People"**

**Western Office and Warehouse:**
**61 So. Clinton St., Chicago, Ill.**

**General Offices:**
**61 Richards St., Brooklyn, N. Y.**

# Uniformity Beyond the Swiss File Maker's Skill

Swiss file makers excel in the manufacture of files by HAND. Their production of fine files is a marvel attained only by practice from earliest youth. Yet American standards of uniformity have bettered the best achievement in

## Nicholson

TRADE X. F. MARK

## Swiss Pattern Files

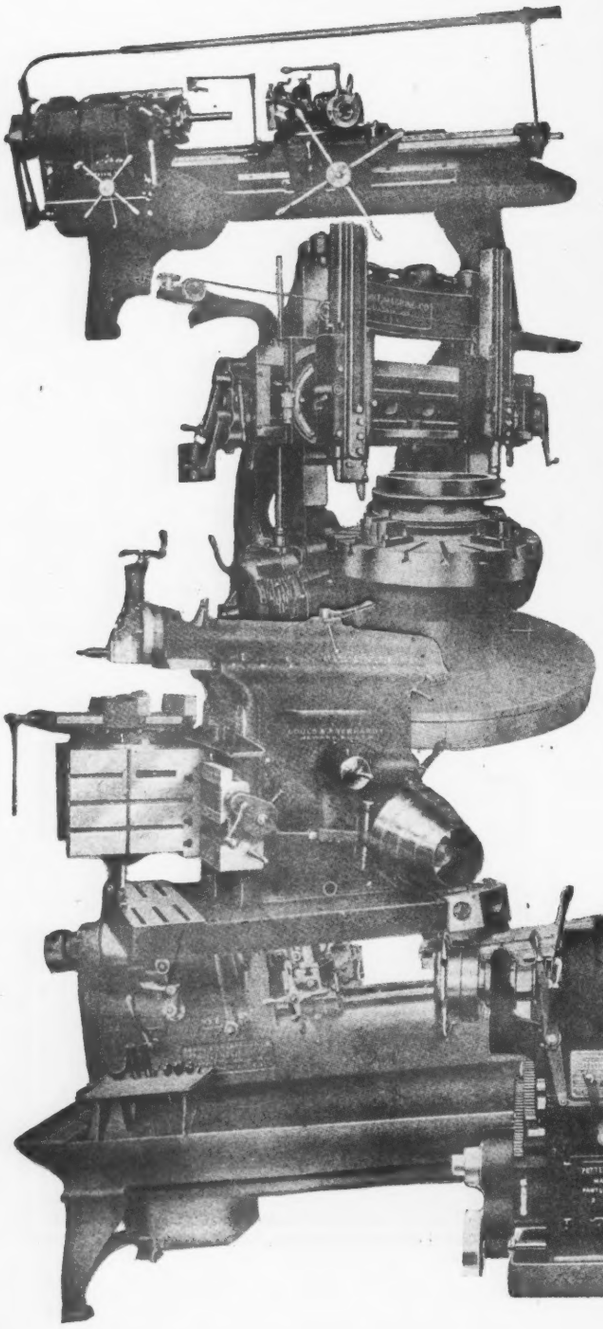
Our X. F. trademark is found only on files that are made with scientific exactness by our specially designed MACHINERY.

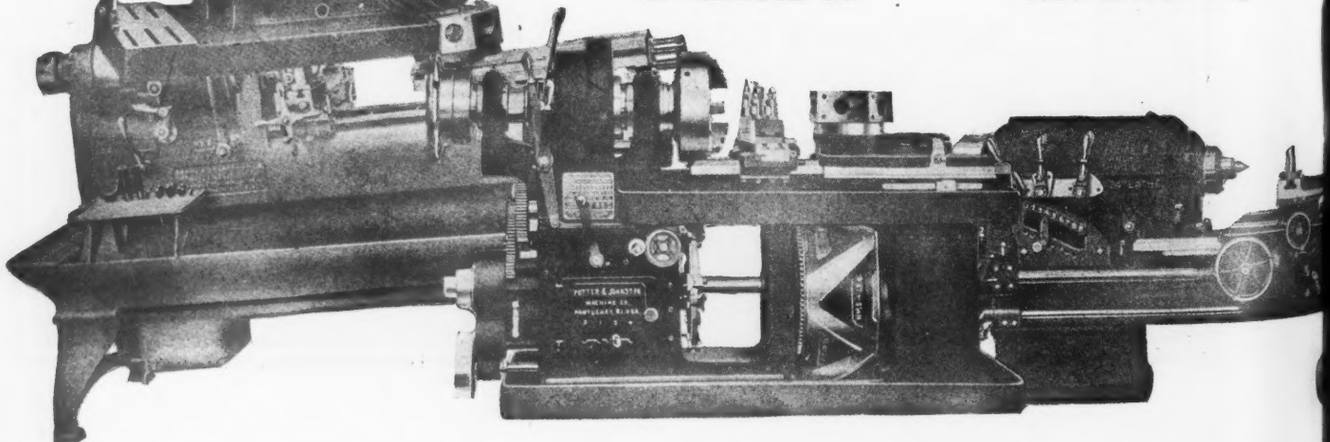
File users find them always a most satisfactory choice for all fine filing requirements.

**NICHOLSON FILE CO.**

PROVIDENCE, R. I.

# GIS





**GISHOLT MACHINE CO.**

EASTERN SALES OFFICE:

**30 Church St. New York City**

# GISHOLT

## Keep Them All Working

They are all money makers when running but not when standing idle while your operators grind their cutting tools.

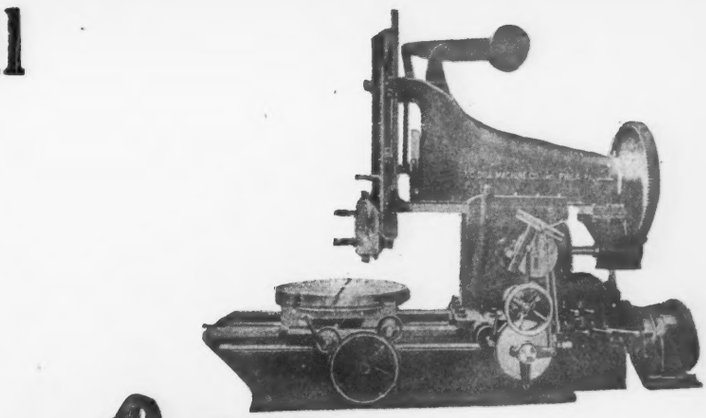
Don't make your men grind their own cutting tools. Install one of these little Gisholt Tool Grinders in a centrally located tool room and then a boy can grind all the tools.

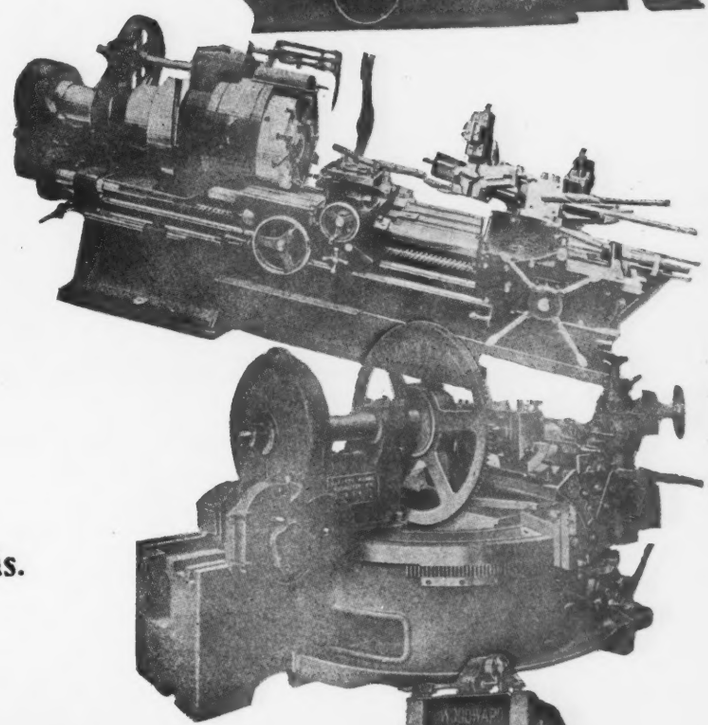
Use the Gisholt method of tool grinding —then your big investment in these fine production machines will keep working for you every minute your shop is running.

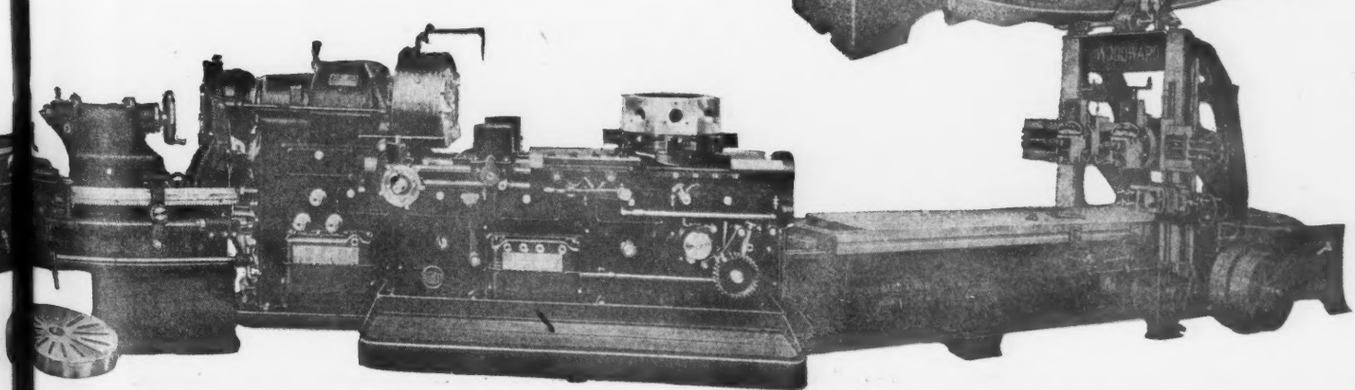
A boy or handy man with this little grinder will grind the cutting tools for all your Engine Lathes, Shapers, Planers, Vertical Boring Mills, Screw Machines, Gear Planers, Slotters, etc.

*The advantages are too many to enumerate here.*

*Send for the Grinder Book*
*—it tells the whole story.*







**GENERAL OFFICES:**
**9 S. Baldwin St. Madison, Wis.**
**Works: Madison, Wis., Warren, Pa.**

# The Multi-Graduated Precision Grinder

**Motor driven.**

**Mounted on the Cross-head of a Lathe it quickly grinds Milling Cutters**

THIS Multi-Graduated Precision Grinder is grinding the face of a straddle milling cutter; the latter being mounted on an arbor supported between centers.

This is but one of hundreds of jobs which this marvelously accurate little machine performs with precision and dispatch.

Weighing only 50 lbs., it is easily taken where required, and its usefulness greatly increased.

Its scientific construction prevents the transmission of vibration to the spindle, and assures fine finish and accuracy.

The Multi-Graduated Precision Grinder grinds *Threads, Thread Gages, Cutting Tools, Plain Surfaces, External and Internal Cylinders.* Write for interesting literature.

**PRECISION AND THREAD GRINDER MFG. CO.**

**1932-34 ARCH STREET** **PHILADELPHIA, PA., U. S. A.**

*Interesting News for Gasoline Engine Builders*

# The New LANDIS Crank Grinding Machine

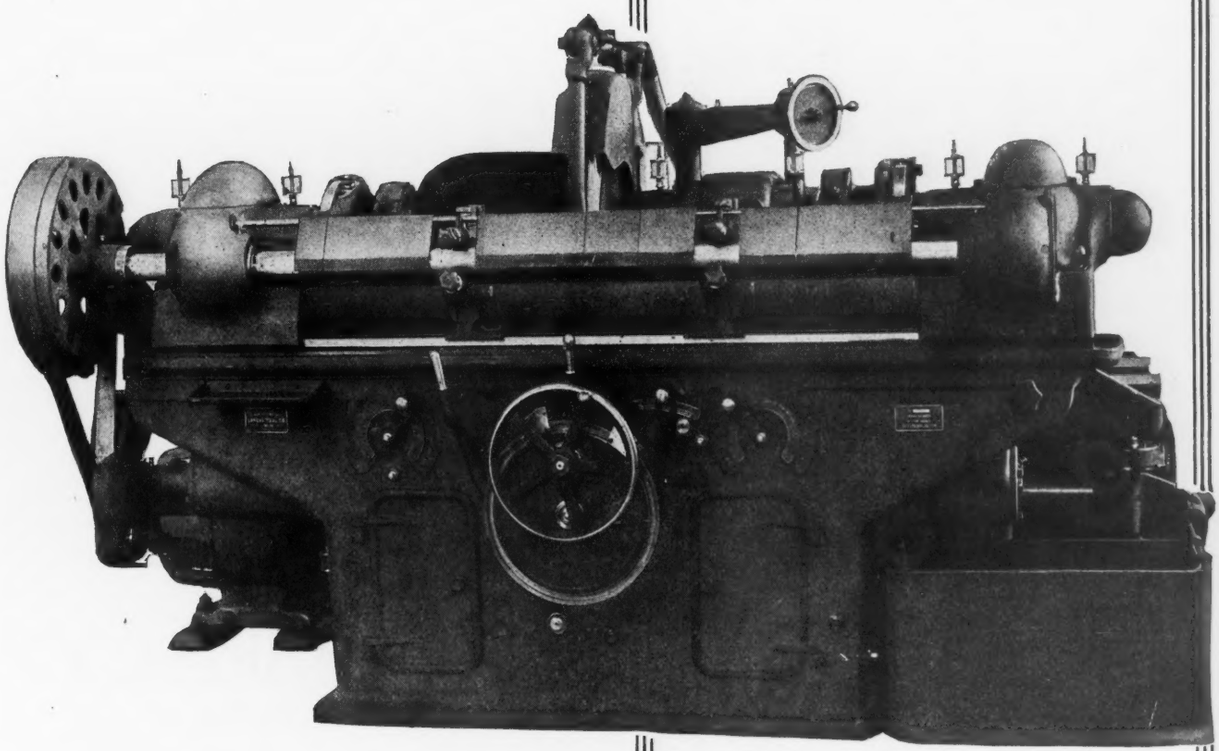
DO you grind crank pins for airplane, automobile, tractor, truck or other gasoline engines? Then you should know about this new design LANDIS which upholds traditional LANDIS accuracy and LANDIS production.

The crank shafts are driven from both ends, both right and left hand crank heads being geared together. A micrometer sliding adjustment with graduated dial on the crank carrying fixtures adjusts the machine for the grinding of different throws.

The crank head spindles are of large diameter, with long phosphor bronze bearings adjustable for wear. The spindle gear is mounted between spindle bearings, an arrangement which permits of mounting the work-carrying fixtures directly on the end of the spindle, close to the bearings. This construction reduces overhang to the minimum.

The grinding wheel traverse feed is automatic, all the respective speeds are obtained by belt shift through the movement of a single lever.

Many other points of advantage are covered in the catalog. Write for it.



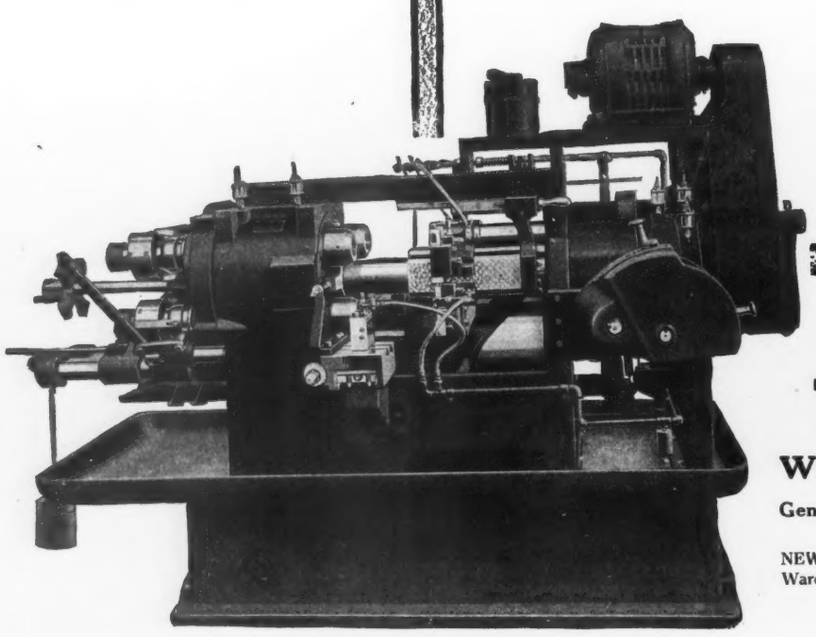
**LANDIS TOOL CO.**
**Waynesboro Pennsylvania**
**New York Office: 50 Church Street**

**Agents:** Birmingham, Alabama: Dewstoe Machine Company
San Francisco and Los Angeles: Harron, Rickard & McCone

# DEPARTMENT PRODUCTION

Any delay in a single department means holding up the entire shop. It is the working-together of all that determines the final output.

Present-day quantity production has made the rapid completion of duplicate parts one of the most important elements in manufacturing. As such it deserves careful attention.



**Gridley Multiple Spindle Automatics — Capacities up to 2⅝" diameters.**

## THE NATIONAL WINDSOR

**General Offices, Cleveland, Ohio**

NEW YORK BOSTON BRANCH CHICAGO

Warehouses: New York and Chicago

# AND FINAL OUTPUT

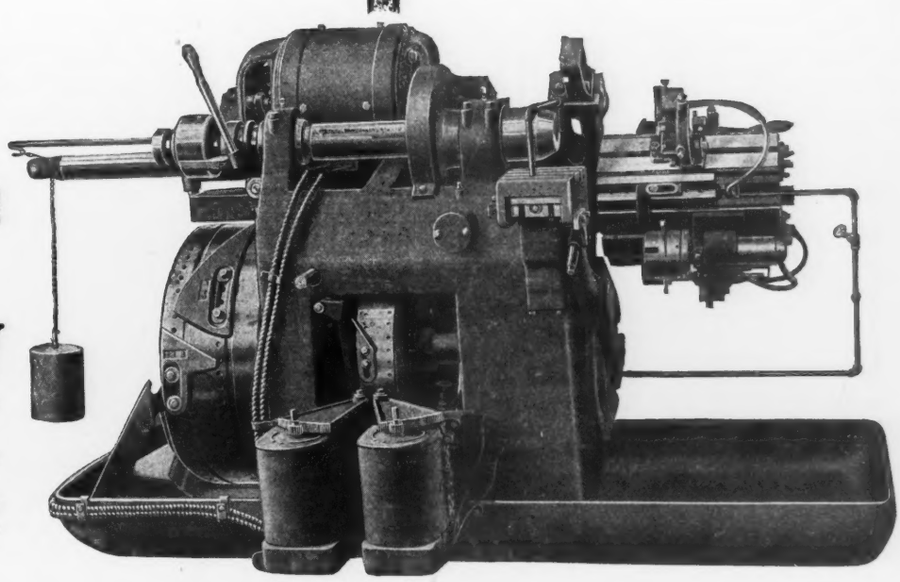
If your duplicate parts are not coming through as they should, why not investigate new methods of making them—that is, *automatically* on machines of proved merit.

## Gridley Automatics

Our quotations on your work will aid you and, besides, place you under no obligation.

***There's a catalog ready for your files.***

**Gridley Single Spindle Automatics — Capacities up to 5" diameter.**



**ACME COMPANY**
**VERMONT**

**Canadian Screw Plant, Montreal, P. Q.**

OFFICES
DETROIT ATLANTA SAN FRANCISCO
Representative in Foreign Countries

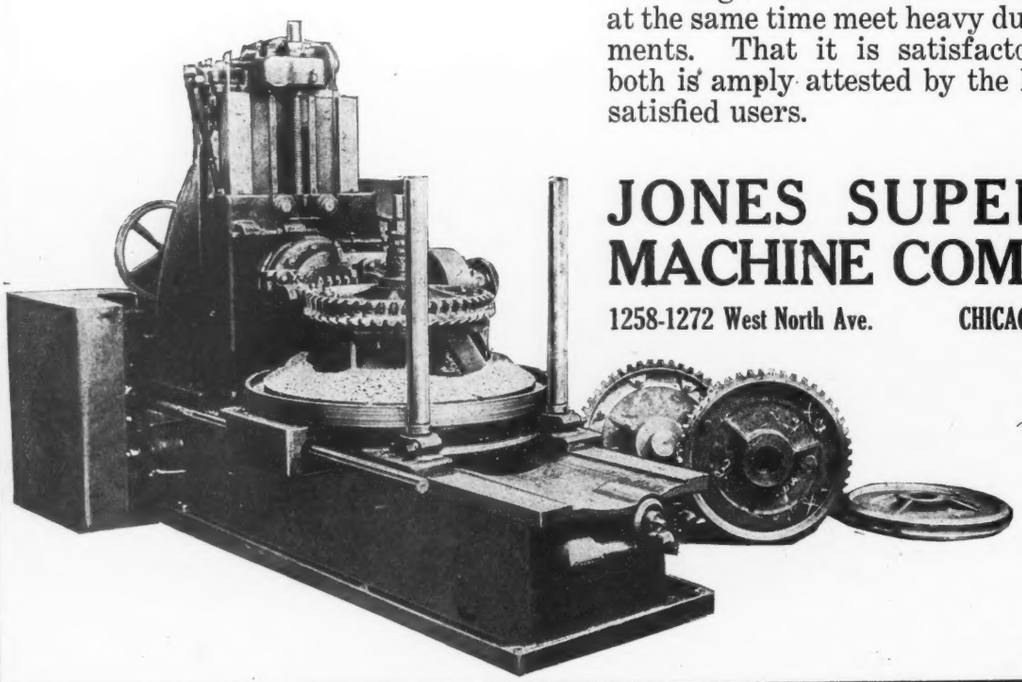
# JONES SUPERIOR Number 48

## *The Utmost in Gear Hobbers*

*Our "Superior" Bulletin gives a comprehensive description of the Jones Superior Automatic Gear Hobbing Machine. It's well worth seeing. Send for it today.*

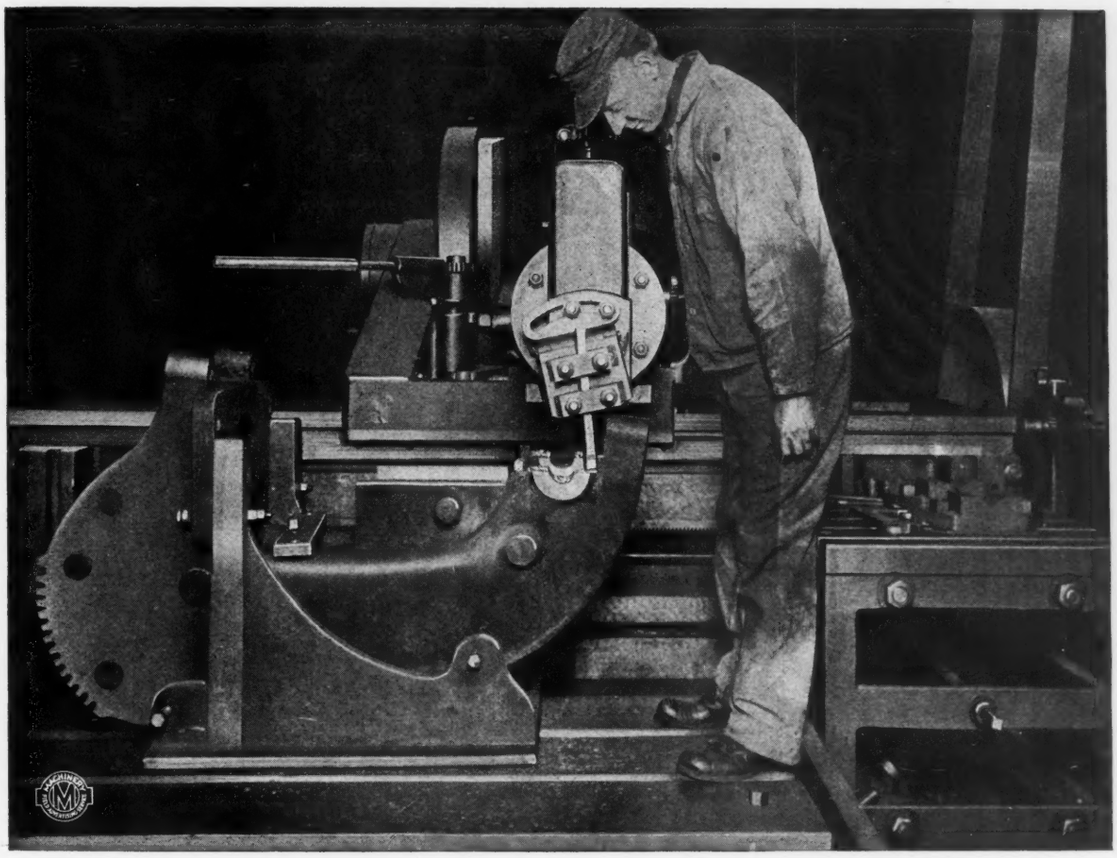
It is conceded that the hobbing process of gear generation is both most accurate, and the best for production. This, however, is provided the hobbing machine is sufficiently heavy and rigid to stand the great strain to which it must necessarily be subjected, particularly in the case of gears of large diameter and heavy pitch.

The Jones Superior No. 48 is designed and built to give the utmost in accuracy, and at the same time meet heavy duty requirements. That it is satisfactorily doing both is amply attested by the long list of satisfied users.



**JONES SUPERIOR MACHINE COMPANY**

1258-1272 West North Ave. CHICAGO, ILL., U. S. A.



# How a Company Saved 50 Per Cent By Changing Its Mind

The Loshbough-Jordan Tool & Machine Co., Elkhart, Ind., knows a good machine when it sees one—it makes them (presses) and is a keen judge of values.

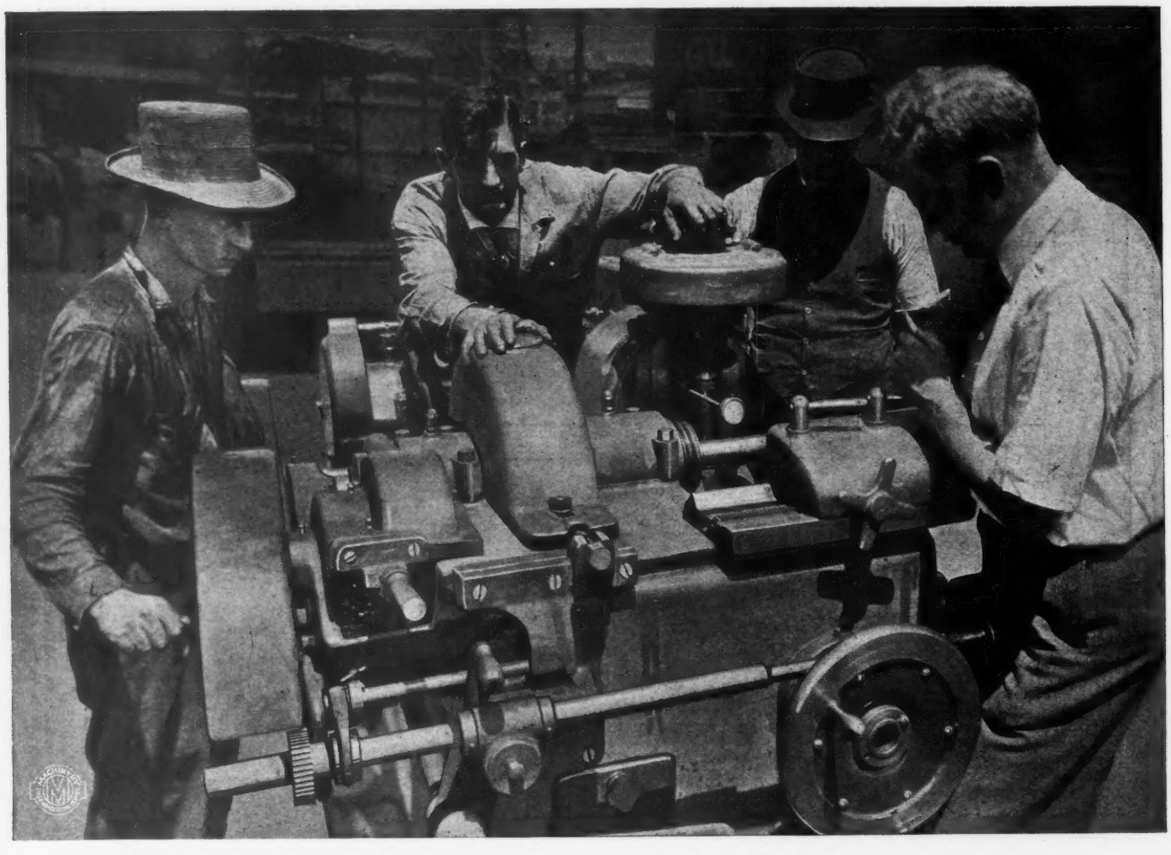
How manufacturing costs are kept down and reasonable selling prices maintained in the face of the present labor market is illustrated by the photograph showing a Cincinnati Single-Head Traverse Shaper machining a heavy press frame. This company in the first instance had decided a planer was necessary; but by changing its mind when the advantages of the Cincinnati Shaper became evident, saved not only 50 per cent of the investment, but also reduced the time of the operation through the advantage of the shaper speed. Then, too, the operating expense was reduced more than half, due to the difference in the power required to move the light ram of the Cincinnati Shaper, and that needed to reciprocate the press frame, fixture and heavy planer table.

***Is there a Cincinnati Shaper job in your plant? The subject is worth investigating.***

## THE CINCINNATI SHAPER COMPANY

### CINCINNATI, OHIO, U. S. A.

AGENTS: Manning, Maxwell & Moore, Inc., New York City, Boston, Mass., Buffalo, N. Y., Chicago, Ill., Cincinnati, Ohio, Cleveland, Ohio, Milwaukee, Wis., New Haven, Conn., Philadelphia, Pa., Pittsburgh, Pa., St. Louis, Mo., Seattle, Wash. Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo. National Supply Co., Toledo, O. Wolverine Machinery & Supply Co., Detroit, Mich. Herberts Machinery & Supply Co., Los Angeles, San Francisco, Cal. FOREIGN AGENTS: Charles Churchill & Co., Ltd., London, E. C. England. Aux Forges de Vulcain, Paris, France. C. Shinz, Petrograd, Russia. McPherson's Proprietary, Ltd., Melbourne and Sydney, Australia. H. W. Petrie, Ltd., Toronto, Canada. Williams & Wilson, Ltd., Montreal, Canada. Taylor Engineering Co., Ltd., Vancouver, B. C. Canada. Andrews & George Co., Tokyo, Japan.



# Inspection Standards are Extremely Rigid

*No. 10 of a Series of Demonstrating Talks*

My company, I find, has the quality of being fussy over certain standards which the fellows, all of them, find decidedly rigid.

My direct interest, of course, is in finished machines, but I realize that if it were not for the unvarying rule which demands manufacturing inspection limits of fractions-of-a-thousandth for parts and units before final assembly, my job on the road might not be so free from worry as it is.

When I get a new machine to demonstrate, I need never worry about the machine itself. When it passes Lees-Bradner inspection it is O. K., not approximately right, but right. And it *has* to pass this inspection before it gets on the road.

The picture shows the inspection of the work slide and the work spindle alignment and rotation with master arbor and indicator. All working parts are manipulated by the chief inspector, and must have the necessary sensitiveness *before* delivery; something which many machines are only expected to acquire after a limbering up period.

If there is one man in the world who can appreciate what it means to receive a new machine like this, it is your humble servant.

The Lees-Bradner O. K. is my assurance that I won't have anything to "explain away."

THE LEES-BRADNER COMPANY CLEVELAND, OHIO

*Pioneers in gear-generation and still in the lead*

GEAR GENERATORS

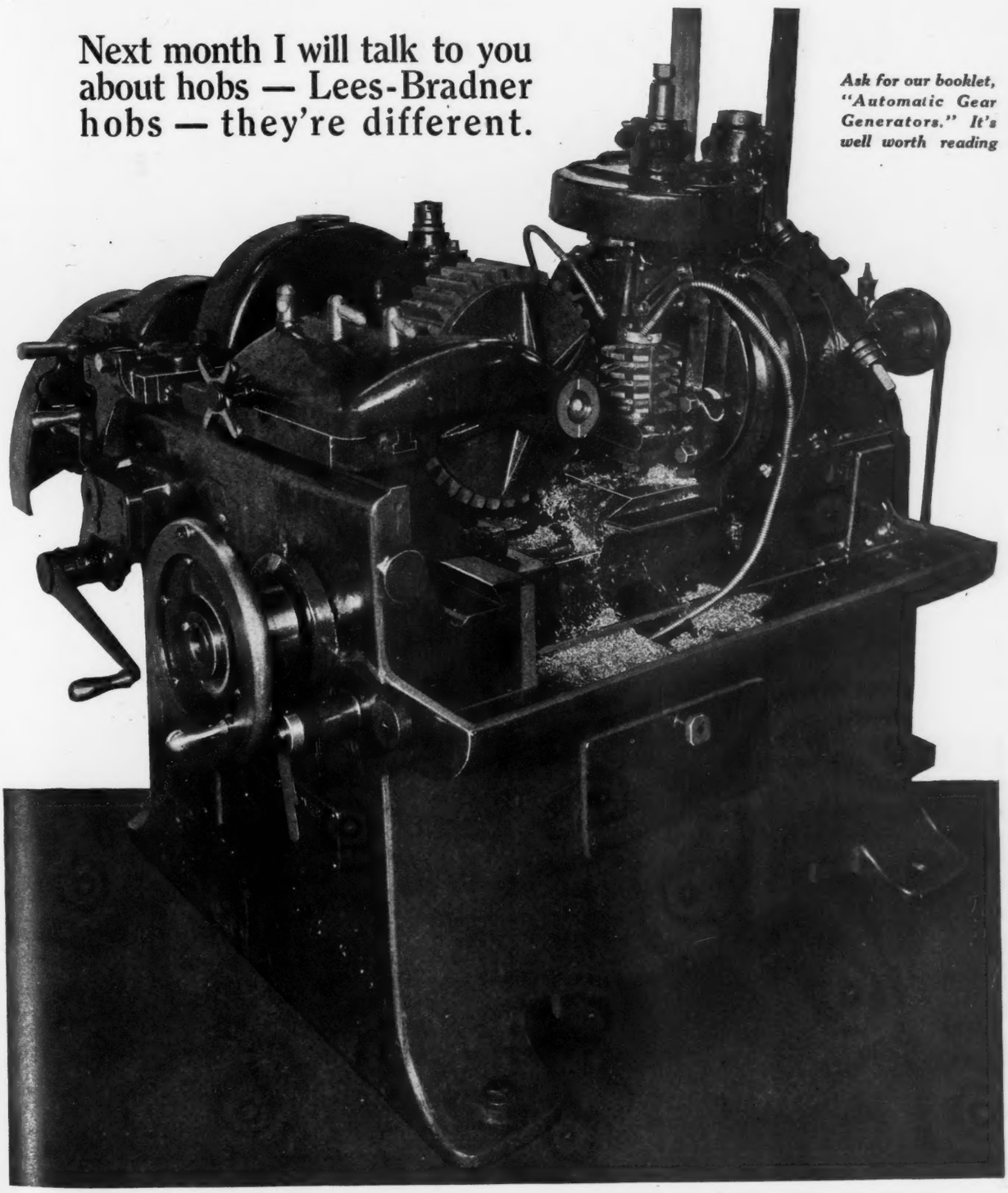
# LEES-BRADNER

THREAD MILLERS

# LEES-BRADNER GEAR GENERATOR

Next month I will talk to you about hobs — Lees-Bradner hobs — they're different.

*Ask for our booklet, "Automatic Gear Generators." It's well worth reading*



# JACKSON
## No. 10 Duplex Typeless Die Sinker

## Machine-Made Intricate Shapes

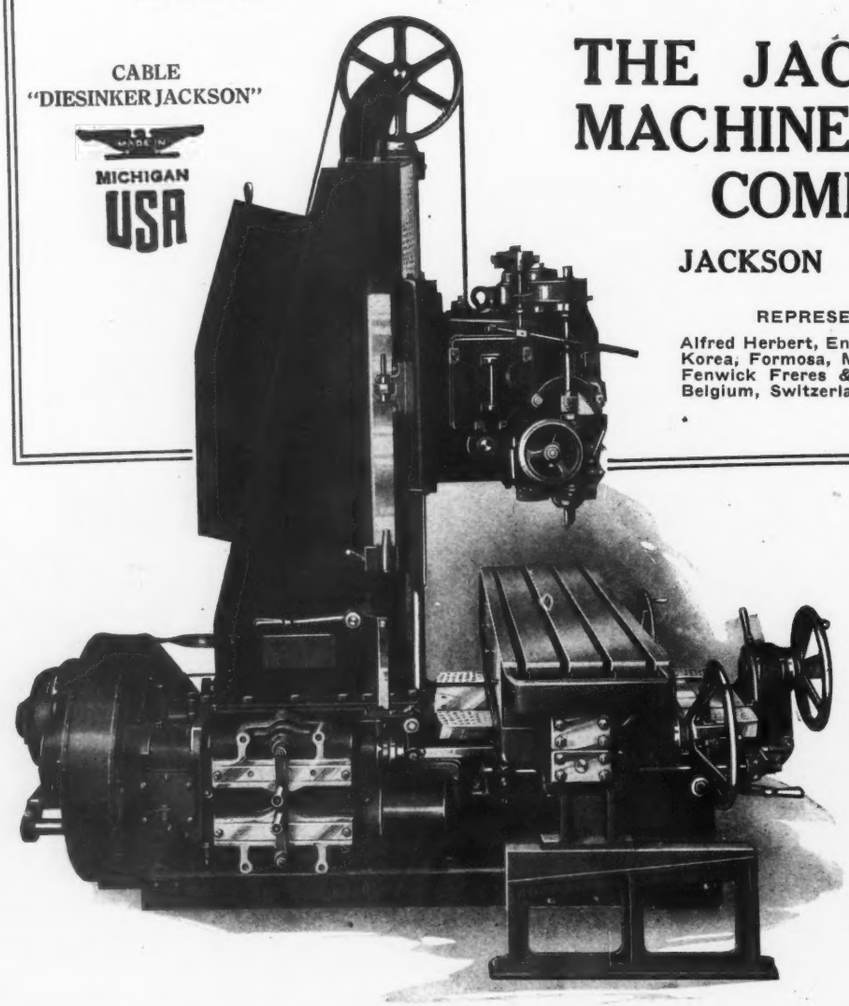
Die sinking, as it used to be, was a tedious, expensive operation which had to be performed by highly skilled labor by hand.

Die sinking, as it is now, presents no greater problem than any other machining operation of like intricacy; IF—— and here's the crux of the whole matter—you use the Jackson Duplex Typeless Die Sinker.

The head of the Jackson is a triumph of mechanical construction. Its three cutting tools—each with its own distinctive uses—make the sinking of intricate shapes, for the first time, a machine tool achievement.

CABLE
"DIESINKER JACKSON"

MADE IN
MICHIGAN
USA



**THE JACKSON MACHINE TOOL COMPANY**

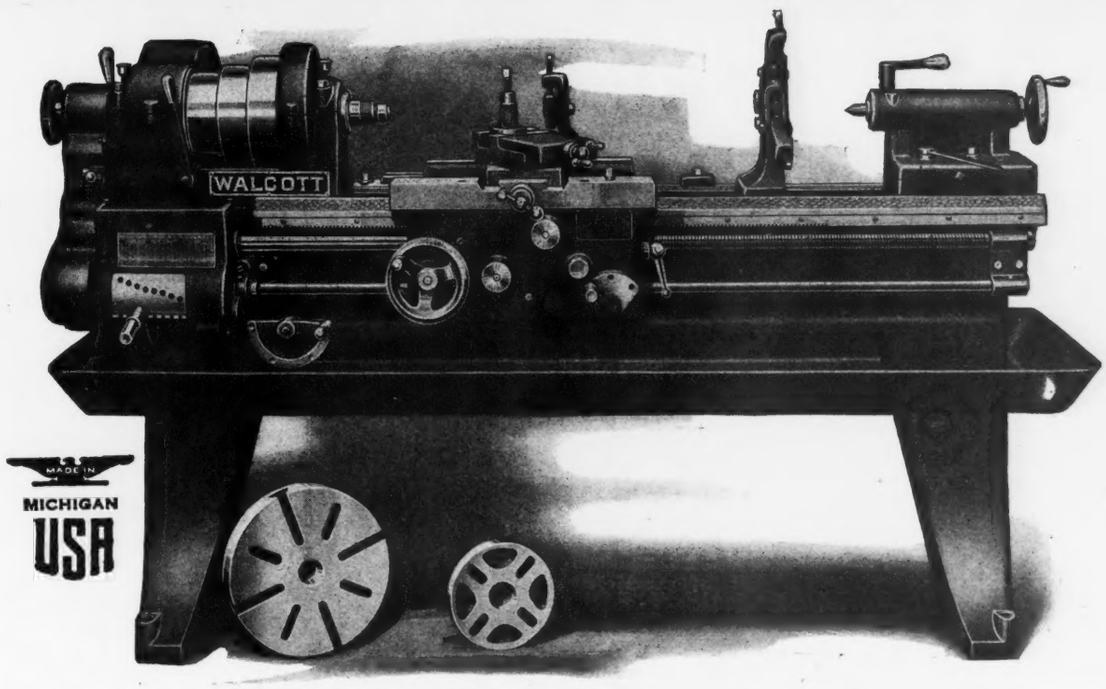
JACKSON MICHIGAN

REPRESENTATIVES

Alfred Herbert, England, Japan, China, Korea, Formosa, Manchuria and Italy.
Fenwick Freres & Company, France, Belgium, Switzerland and Brazil.

*You'll want to know all about the three sizes of Jackson Die Sinkers, and which of them would best suit you. Your name and address on a postal will suffice. Do it now.*

# WALCOTT




## CONSERVATIVE PROGRESS

Conservative yet progressive factory administration of practical men has resulted in the immense growth of the Walcott Lathe Company. From a plant covering 2000 square feet it now occupies a space 2½ city blocks in area.

This great organization concentrates on the manufacture of one product—Walcott Lathes. Is it any wonder that their lathes have reached a standard of excellence which is unsurpassed?

Limited space prohibits the description of the many big production features of Walcott Lathes. It is enough to say that every essential detail will be found in their construction which is vital in modern shop practice.

***Sizes from 14 to 29 inch. Write for Catalogue.***

## WALCOTT LATHE COMPANY

**115 CALHOUN STREET JACKSON, MICHIGAN, U. S. A.**

DOMESTIC AGENTS.

Hill, Clarke & Co.....Chicago, Ill.
W. E. Shipley Machine Co...Philadelphia, Pa.
National Supply Co.....Toledo, Ohio
Motch & Merryweather Mchy. Co.,
Cleveland, O., and Pittsburgh, Pa.
H. A. Smith Mchy. Co.....Syracuse, N. Y.
William E. Duff..York, Pa. & Jacksonville, Fla.
P. H. Reardon.....San Francisco, Cal.
Brown-McDonald Mchy. Co.....St. Louis, Mo.
Smith-Booth-Usher Co.....Los Angeles, Cal.
Factory & Mill Supply Co.....Boston, Mass.
Hendrie & Bolthoff Mfg. & Supply Co.,
Denver, Colo.
Gordan & Finkbeiner.....Portland, Ore.
Northern Mchy. Co.....Minneapolis, Minn.
Brownell Mchy. Co.....Providence, R. I.
Walcott Lathe Co., Detroit Store,
Detroit, Mich.

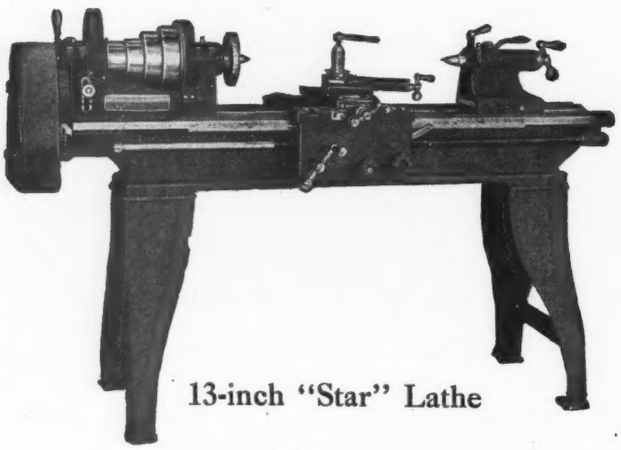
FOREIGN AGENTS.

Fenwick, Freres & Co.,
Paris, France, Rio De Janeiro, Brazil
Buck & Hickman, Ltd.....London, England
Alfred Herbert, Ltd.....Coventry, England
Standard Mchy. & Supplies, Ltd.,
Montreal, Quebec
William E. Duff.....Tokyo, Japan
Canadian Fairbanks-Morse Co.,
Toronto, Ont. and Vancouver, B. C.

# STAR LATHES

## The Proper for Shop and

Modern manufacturing methods demand modern equipment. The shop today must keep pace with progress. "Star" Lathes embody the experience of this organization acquired in 36 years manufacturing good lathes—lathes that are giving excellent service in hundreds of well-known industries. "Star" Lathes possess every accepted improvement and many special features. They are unusually strong, compact and accurate—easily operated—and have certain refinements of design and build that secure best results at lowest production costs.

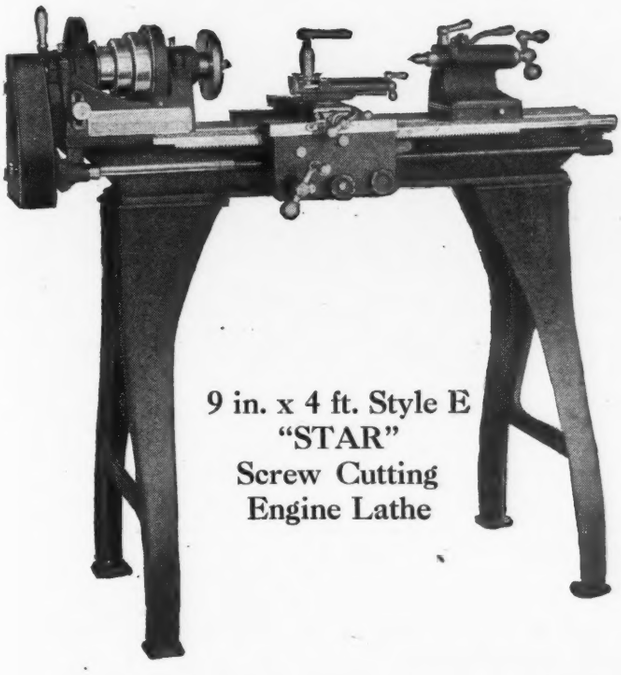


13-inch "Star" Lathe

## The Seneca Falls Mfg. Co., Inc.

# Equipment Factory

11 in. x 5 ft. Style H
"STAR"
Screw Cutting
Engine Lathe



9 in. x 4 ft. Style E
"STAR"
Screw Cutting
Engine Lathe

"Star" Lathes are built in 9-in., 11-in., 12-in. and 13-in. swing sizes with a large line of attachments available.

The capacity and range of these lathes make them ideal machines for tool room and factory.

Have you read "Increasing the Scope of the Small Lathes"? It's free.

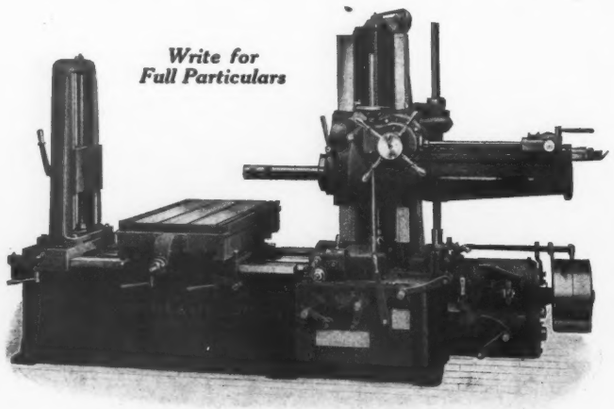
## Some Representative Users of "STAR" Lathes

Geometric Tool Co., New Haven, Conn.
Sargent & Company, New Haven, Conn.
Western Electric Co., St. Louis, Mo.
Remy Electric Co., Anderson, Ind.
Pullman Free School, Kensington, Ill.
S. F. Bowser & Co., Fort Wayne, Ind.
Bosch Magneto Co., Chicago, Ill.
Taylor Instrument Cos., Rochester, N. Y.
Crocker-Wheeler Co., Ampere, N. J.
Union Twist Drill Co., Athol, Mass.
Savage Arms Co., Utica, N. Y.
Carborundum Co., Niagara Falls, N. Y.
General Electric Co., Schenectady, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Brown-Lipe-Chapin Co., Syracuse, N. Y.
Gray & Davis, Boston, Mass.
Splitdorf Electrical Co., Newark, N. J.
U. S. Government.

# 381 Fall St., Seneca Falls, N. Y.

# An Important Link In The Production Chain

## G. & L. No. 0 Horizontal Boring, Drilling and Milling Machine




LITTLE jobs and big jobs—light castings such as the operator is just setting up on the machine—big ones like the piece in the chains, weighing 700 pounds—all come to this Giddings & Lewis boring machine. The scene shown correctly pictures Giddings & Lewis performance in this shop; one job literally treading on the heels of its predecessor.

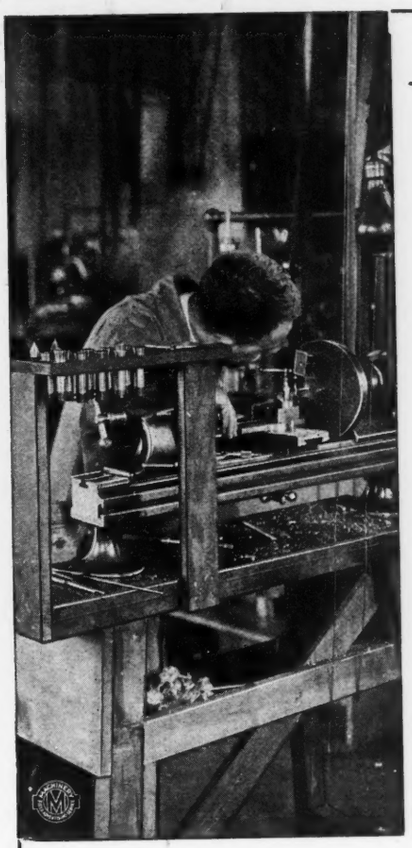
The Michigan Machine Company in handling a big rush of fine tool work—jigs, fixtures and dies for various big automobile concerns in their home city of Detroit—have found the Giddings & Lewis boring machine of exceptional value.

The work being set up is a valve-cage, a contract job for the Maxwell Motor Co. It is a flanged iron casting, and is mounted on the circular boring-fixture attached to a G & L rotary table. The flange is 22″ diameter. Two blind holes at each end will be bored, both of them being 6¾″ diameter and 5¾″ deep. This explains the use of the rotary table, which permits graduations on a common center line. A simple job—true! Yet it serves to indicate the *range* covered by the Giddings & Lewis machine.

## Giddings & Lewis Manufacturing Co., Fond Du Lac, Wis.

DOMESTIC AGENTS: Taylor Machinery Co., Boston; Fairbanks Co., New York, Albany, New Orleans, Hartford; Kemp Machinery Company, Baltimore, Md.; H. A. Smith Machinery Co., Syracuse; Swind Machinery Co., Philadelphia; E. A. Kinsey Co., Cincinnati, Indianapolis; Motch & Merryweather Machinery Co., Pittsburgh, Cleveland, Detroit; Blackman-Hill-McKee Mchy. Co., St. Louis; Stocker-Rumely-Wachs Co., Chicago, Milwaukee; English Tool & Supply Co., Kansas City; Sunderland Machinery & Supply Co., Omaha; Hendrie & Bolthoff Mfg. & Supply Co., Denver; Salt Lake Hardware Co., Salt Lake City; McMullen Mchy. Co., Grand Rapids, Mich.; Homer Strong, Buffalo, Rochester. Smith-Courtney Company, North and South Carolina. FOREIGN AGENTS: Canadian-Fairbanks-Morse Co., Toronto, Montreal, Winnipeg, Vancouver; Fenwick Freres & Co., Paris, Lyons, Liege, Zurich; Burton-Griffiths & Co., England; R. L. Scrutton & Co., Ltd., Sydney, Australia; Wilh. Sonesson & Co., Copenhagen; Gustav Nielsen, Christiania.

# If it is a Fine Job, Take it to the Ames

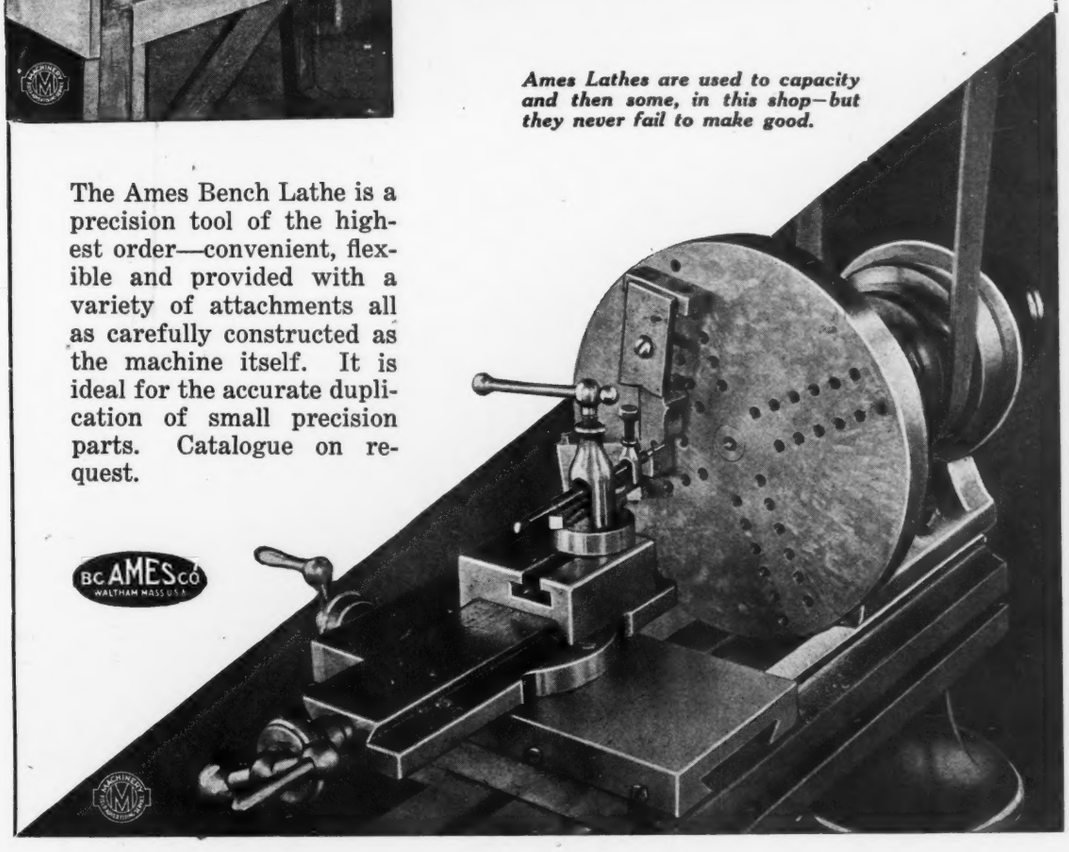


## The Ames Precision Lathes

The Meldrum, Semon & Greiner Co., Syracuse, N. Y., has recently acquired two Ames Bench Lathes, which are proving invaluable for turning punches, boring small dies and jigs and in the various kinds of experimental work for which this company is noted.

One of these machines is here shown, helping to produce segments of a cylindrical surface for which the radius must be accurate.

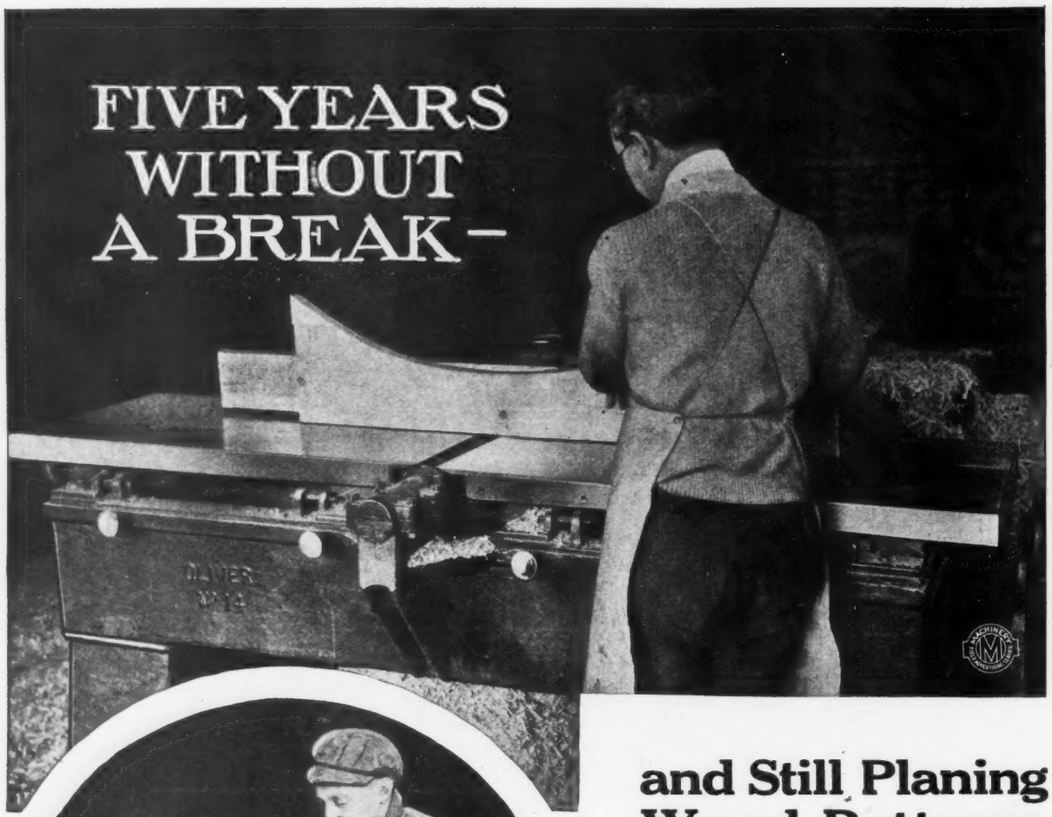
*Ames Lathes are used to capacity and then some, in this shop—but they never fail to make good.*



The Ames Bench Lathe is a precision tool of the highest order—convenient, flexible and provided with a variety of attachments all as carefully constructed as the machine itself. It is ideal for the accurate duplication of small precision parts. Catalogue on request.

B.C. AMES CO. WALTHAM MASS. U.S.A.

## THE B. C. AMES COMPANY, Waltham, Mass.



## and Still Planing Wood Patterns True to Shape

"The most easily adjusted planer I have ever used" is the comment of the foreman in the Eclipse Pattern Company's (Pittsburgh, Pa.) plant where this Oliver Hand Planer and Jointer was photographed.

"The tables line up nicely. I'll show you." He ran a cut over a thin strip of wood and exhibited the true surface produced.

The machine has been at the disposal of about twenty-five men for the past five years and they have kept it pretty busy, but no repairs have been necessary.

The Oliver Hand Planer has a wide range of usefulness to the pattern-maker. It is adapted to cut any contour made up of straight lines, planes and angles. Durably constructed, as this installation proves, and easy to operate, the machine is well worth investigation.

OLIVER

*Complete description of this and other Pattern Shop machines of the Oliver Line furnished on request.*

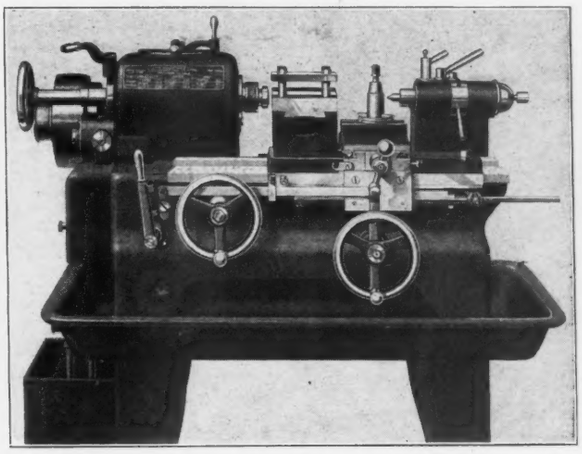
**OLIVER MACHINERY CO.**
GRAND RAPIDS MICH., U. S. A.

The 9-Inch

# "SUNDSTRAND"

*A Production Machine*

Power, accuracy and operating convenience are outstanding features of this simple, high power manufacturing lathe —designed for quantity production of duplicate parts of short length and comparatively small diameter. Its main feature is the bed of entirely new design, with separate ways for carriage and tailstock, so carriage can travel to end of bed in front of tailstock. All-geared type headstock, operated by highly sensitive friction clutch, automatic friction brake, automatic stops, feed reverse, etc., are all controlled with least possible waste motion.



Specifications include: Length of carriage on bed, 18"; diameter of drive pulley 8½"; speed of drive pulley 350 R.P.M.; spindle speeds, 9; feeds, 4; floor space 45" by 24".

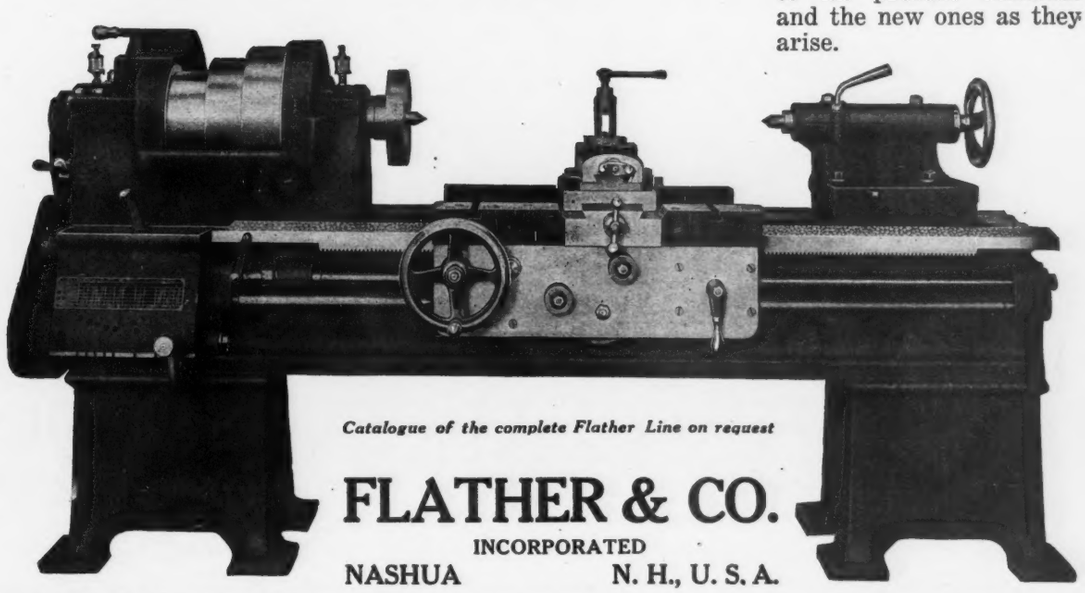
*Details on Request*

**ROCKFORD TOOL COMPANY**

**Harrison Ave. & 11th St.**
**ROCKFORD, ILL., U.S.A.**

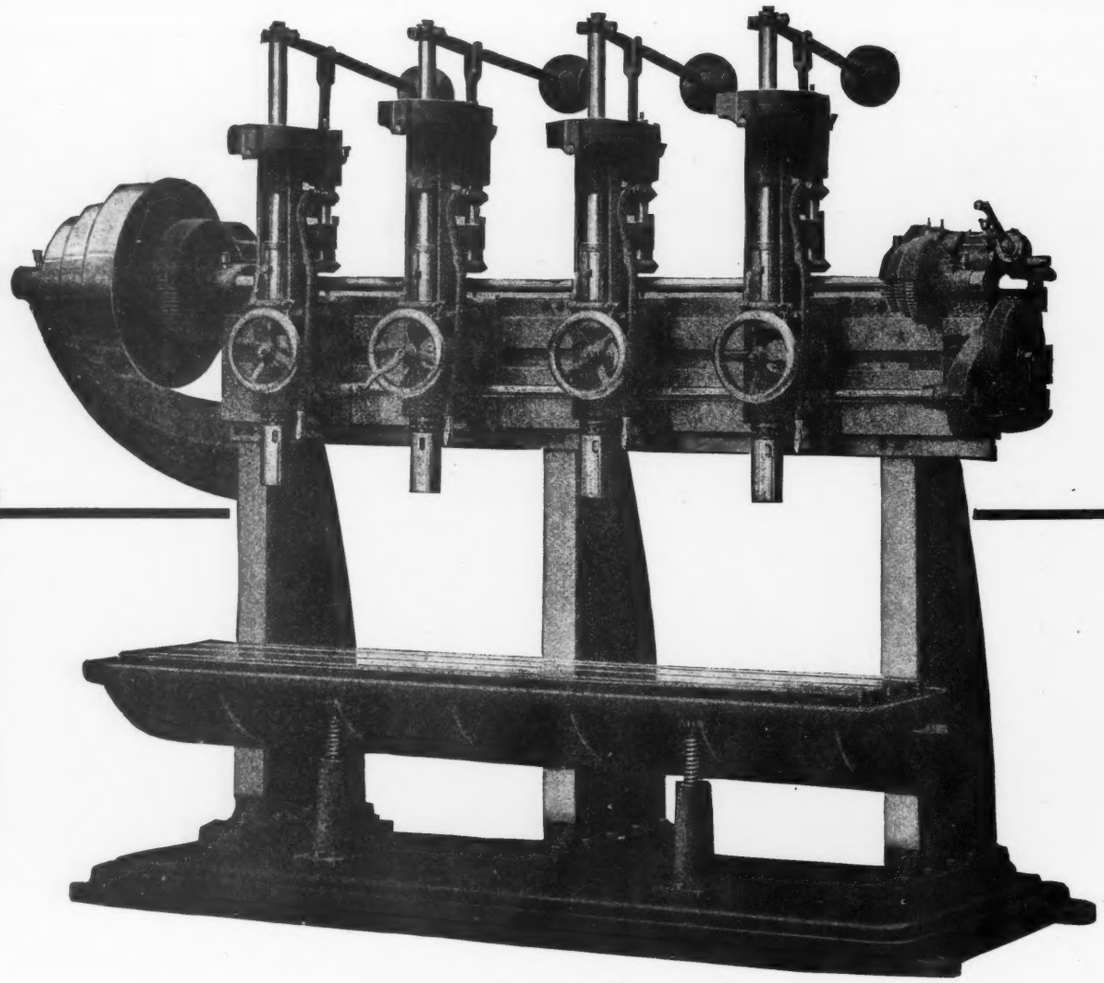
# FLATHER

Profitable machines are the kind that can be depended on to stand up to their work indefinitely. FLATHER LATHES are accurate and retain their accuracy under pressure of continuous service. Their range enables them to fill present demands and the new ones as they arise.



*Catalogue of the complete Flather Line on request*

**FLATHER & CO.**
INCORPORATED
NASHUA N. H., U. S. A.



*Built in Nine Sizes – Capacity ¾ to 3 Inches*

THE tendency of the times to look for best possible results with least expenditure of time, effort and expense has stimulated the highest development of tool and instrument work and produced such masterpieces of the mechanician's art as

# Foote-Burt Indépendent Feed Drills

They are rapid, accurate, versatile machines, designed to perform a wide range of close limit operations at high speed. Centralized control, distinctive quick-change mechanism, broad bearings—carefully scraped and bronze bushed—all steel gears and an exceptionally high ratio of back gearing permit drilling holes up to 2″ diameter in solid steel with perfect safety.

Table has 12″ vertical adjustment and a working surface 19″ x 92″, well adapted to accommodate such work as connecting rods for aircraft, truck, tractor and motor cars, front axles, etc.

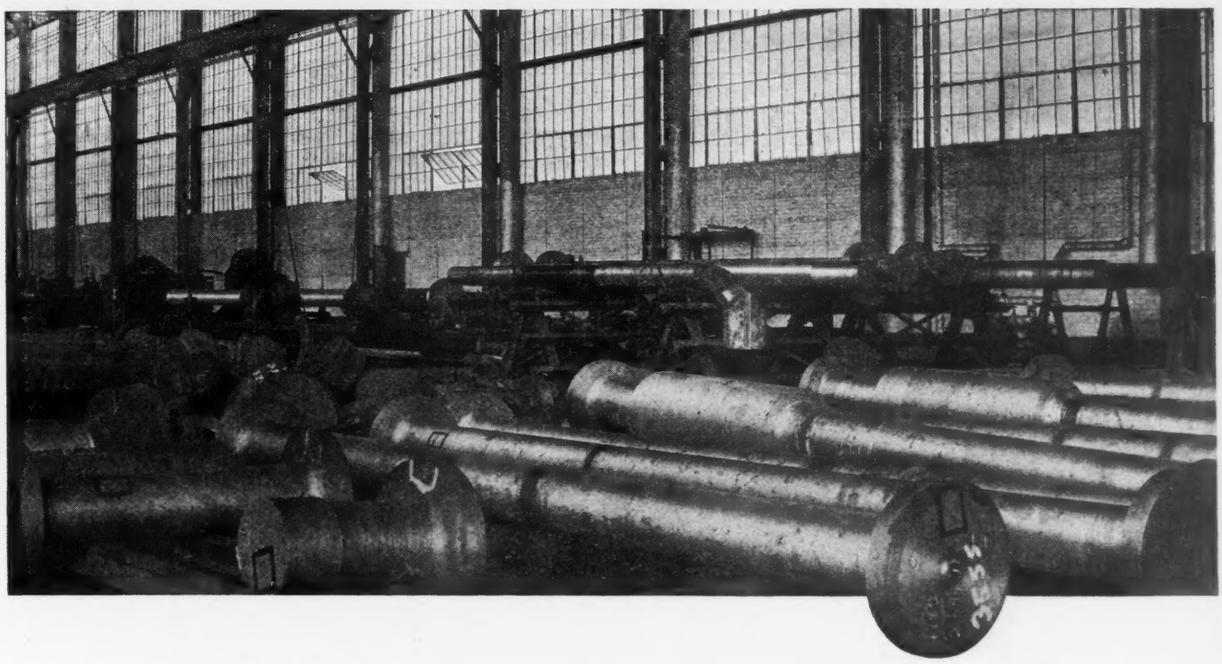
***Complete Description in Circular.***

## THE FOOTE-BURT CO., Cleveland, Ohio

**Milwaukee Office: 633 Wells Bldg.** **Detroit Office: 1457 David Whitney Bldg.**

FOREIGN AGENTS: Buck & Hickman, Ltd., London, Birmingham, Manchester and Glasgow. Moscow Tool & Engine Co., Moscow. Ing. Ercole Vaghi, Milan. R. S. Stokvis & Zonen, Ltd., Rotterdam. R. S. Stokvis & Fils, Brussels. Glaenzer & Perreaud, Paris, agents for France, Switzerland, Spain and Portugal. Mitsui & Co., agents for Japan, Korea and Manchuria.

# CAMDEN



# DON'T STOP

to wonder whether we can make your forgings.

# CAMDEN FORGINGS

are made for innumerable purposes.

We are interested in knowing of your forging requirements. We know that we can interest you in our plant and its product.

Let these considerations lead to our receipt of your forging inquiries.

## *BUYERS' MEMO*

High and Low Carbon Bars
Press Columns and Rams
Pull Back Cylinders
Water Cylinders
Valve Bodies
Plungers
Weldless Steel Rings
Lathe Spindles, solid and hollow bored
Long Feed Screws
Power Press Crank Shafts
Rudder Arms

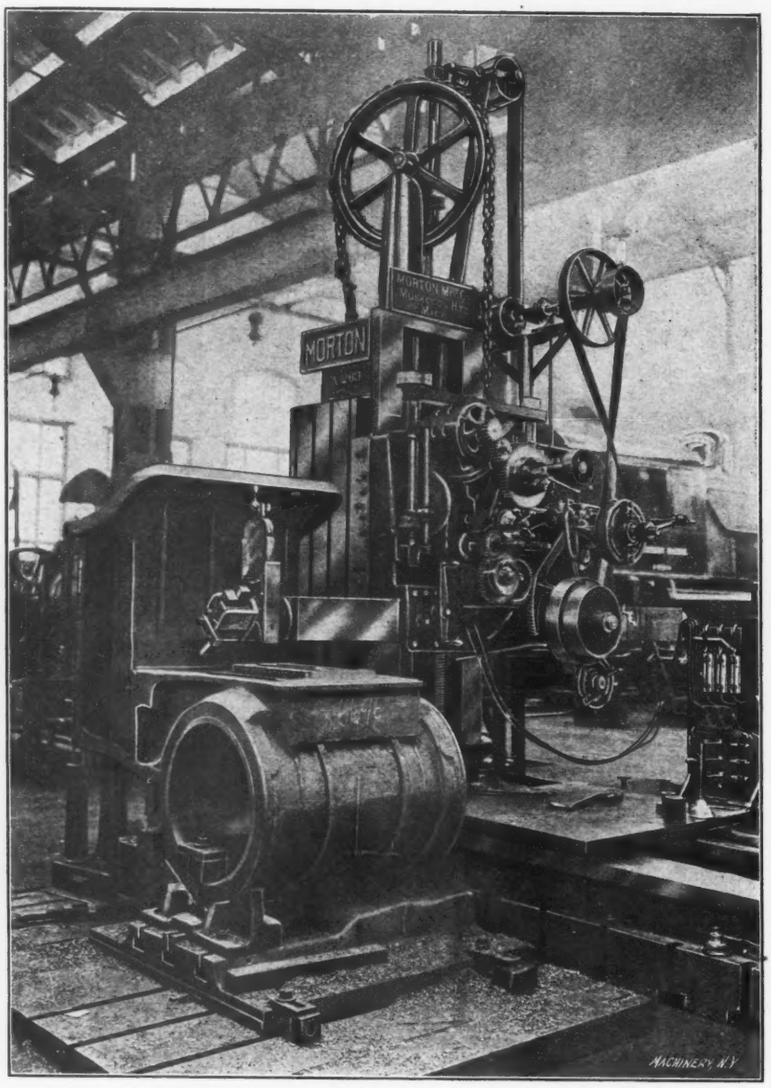
Rudder Stocks
Cam Shafts
Eccentric Shafts
Crusher Shafts
Gear and Pinion Blanks
Locomotives: Side and Main Rods; Crank Pins; Axles; Rod Straps; Guides; Parts of frame both in iron and steel

Hammered Iron Bars for locomotive repairs
Marine Shafts
Marine Connecting and Eccentric Rods
Rolls: Bending; Feed; Straightening; Embossing
Large Wrenches
Saw Arbors

Steam Engine Forgings
Pump Crank Shafts
Pump Connecting Rods
Large Nuts
Turbine Shafts
Mill Shafting
Trolley Car Axles
Electric Motor Axles
Any forging to your print, and specifications, in either iron or steel.

# CAMDEN FORGE CO.
# CAMDEN, N.J., U.S.A.

# The Morton Draw-Cut Traveling Head Planer




***Requires Only One Quarter the Power of a Housed Planer of Equal Capacity.***

From tests made on Morton Draw-cut Planers in all parts of the world, it has been proved that they *operate on one-fourth the power necessary for a housed planer of equal capacity.* The chief cause of this saving is the fact that the relative weights of the moving parts are so small. Overcoming the inertia of the mass in the ordinary housed planer absorbs a very large percentage of power *without its giving any service in return.*

The draw-cut—a distinctive feature of the Morton—is another contributing cause to power saving.

There is none of the vibration and chatter so marked when taking heavy cuts in tough metals with an ordinary planer.

And then the *convenience* of the Morton—the traveling head—practically every part of even the most awkward looking casting can be machined without resetting. The Morton not only planes; it bores, mills and performs a multitude of machining operations, which, in its absence would perhaps necessitate the installation of several machines.

The Morton Draw-cut Traveling Head Planer is in a class by itself—it has no competitors. It's an investment for a business lifetime, and will enormously increase the scope of your plant. Bulletin 8-D tells all about it.

***Write for it to-day.***

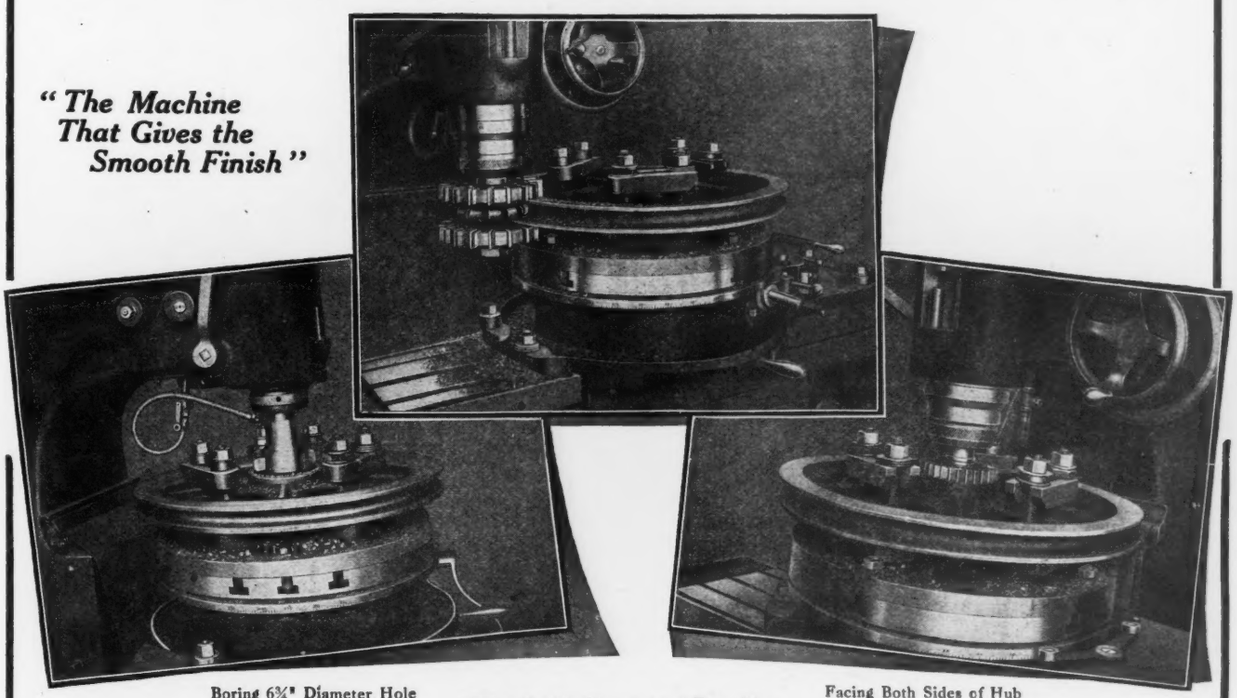
## MORTON MANUFACTURING CO.

**MUSKEGON HEIGHTS** **MICHIGAN, U. S. A.**

# DOUBLE PRODUCTION

## On the Same Job by the Same Workmen

*"The Machine That Gives the Smooth Finish"*



Boring 6¾" Diameter Hole

Milling Outside Diameter and Two Sides

Facing Both Sides of Hub

## A Simple Proof of Machine Superiority

The photographs shown above were taken in the plant of the Mead-Morrison Company at East Boston, Mass. They show real everyday operations—not just posed for photographic purposes—and operations on which the manufacturers have doubled their production by using Becker Belt Driven Millers.

Prior to the installation of Becker Vertical Millers, the best production attained was on a boring mill, 3 hours being consumed. Becker Belt Driven Millers have cut this in half—1½ hours being the time consumed now on the same operation, and the finish is smoother, more accurate and better.

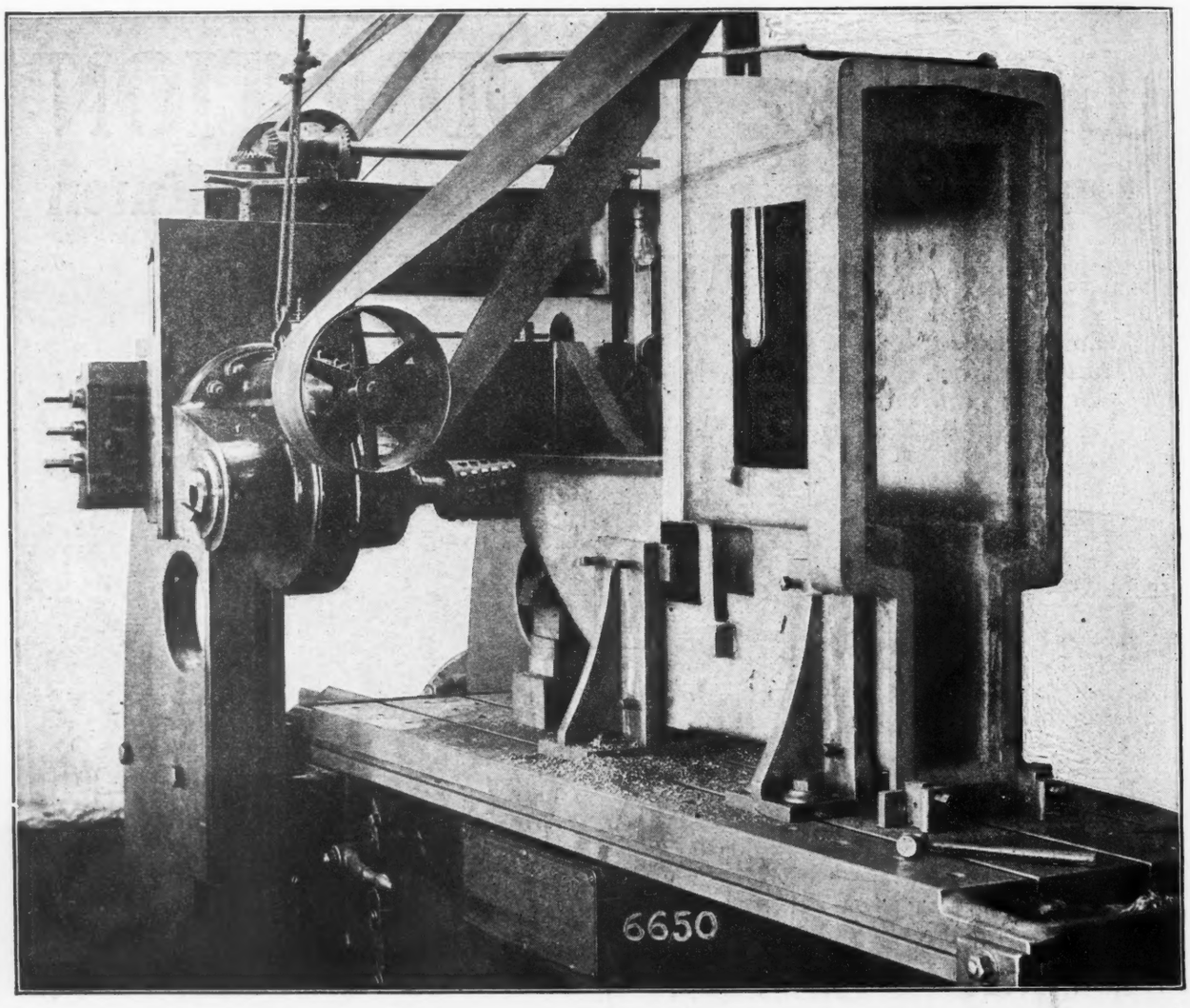
A similar saving may be possible in your plant—investigate today—now.

## BECKER MILLING MACHINE COMPANY

**HYDE PARK, BOSTON, MASS.**

**529 MAJESTIC BUILDING, DETROIT, MICHIGAN** **511 LEMCKE BUILDING, INDIANAPOLIS, INDIANA**

BOSTON.....Niles-Bement-Pond Co.
BUFFALO.....J. L. Osgood
CHICAGO.....E. L. Essley Mchy. Co.
CLEVELAND.....W. M. Pattison Supply Co.
DAYTON.....M. D. Larkin Supply Co.
MILWAUKEE.....E. L. Essley Mchy. Co.
MOLINE.....E. L. Essley Mchy. Co.
MONTREAL.....Rudel-Belnap Mchy. Co.
NEW HAVEN.....Manning, Maxwell & Moore
NEW YORK.....Manning, Maxwell & Moore
PHILADELPHIA....Manning, Maxwell & Moore
PITTSBURGH.....Manning, Maxwell & Moore
SAN FRANCISCO.....Niles-Bement-Pond Co.
SEATTLE.....Niles-Bement-Pond Co.
SYRACUSE.....H. A. Smith Mchy. Co.
TORONTO.....A. R. Williams Mchy. Co.
AUSTRALIA.....Selson Engineering Co.
BELGIUM.....Selson Engineering Co.
ENGLAND.....Selson Engineering Co.
FRANCE.....Selson Engineering Co.
ITALY.....Selson Engineering Co.
SPAIN.....American Machinery Syndicate
SWEDEN.....A. B. Galco, Ltd.
PORTUGAL.....American Machinery Syndicate




# THE FARWELL MILLING MACHINE

doing a job difficult for most shops. The facing off the end of this big stand is done nicely on a planer equipped with a No. 3 Farwell Milling Machine. The end is milled and the top faced and sides planed at one setting, which is a great saving in time.

The convenience of bolting large castings on a planer bed makes a planer equipped with a Farwell Milling Machine more useful than any ordinary miller would be. Where boring, milling and planing are required on the same castings, there is nothing that can compare with this combination for production.

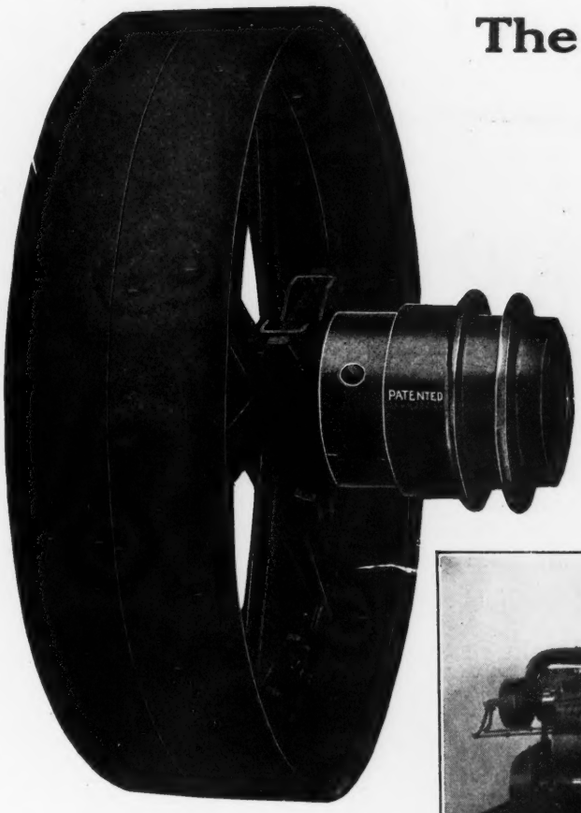
This combination makes a vertical and horizontal Milling Machine, Boring Mill and Planer all in one.

We would like to send you a copy of our catalog No. 57 as well as any other information you may desire. Write.

**THE ADAMS COMPANY,** 1908 Market Street Dubuque, Iowa, U. S. A.

# The Johnson Friction Clutch Is Being Used As A Part Of This Machine

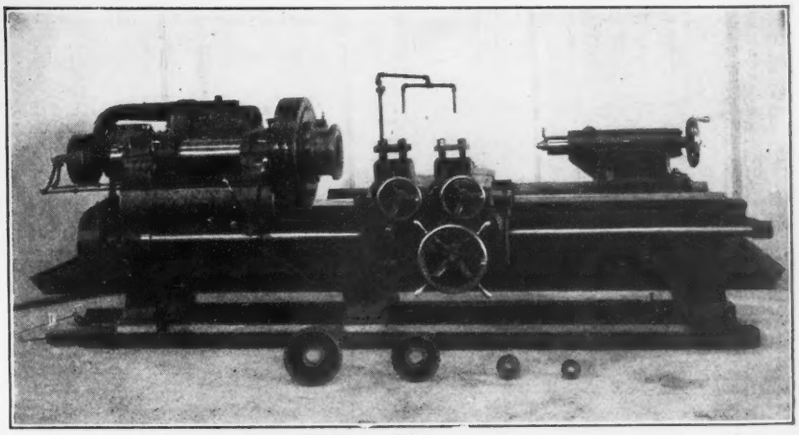
## This 25" Gisholt Lathe is Equipped with The Johnson Friction Clutch




Single Clutch, Pulley Mounted on Hub.

Johnson Friction Clutches are practically universal in their application. As a part of the shop transmission system they simplify the application of power and facilitate its control. Incorporated in the various movements of many well-known machines and machine tools, they materially increase operating efficiency. On the main driving pulley of this Gisholt Lathe, delivering 20 to 25 H. P., at a speed of 280 R. P. M., the Johnson Friction Clutch insures ease of operation and increases the usefulness of the machine.

*Get the facts. Write for Catalog "A"*



Courtesy Gisholt Machine Co., Madison, Wis.

## THE CARLYLE JOHNSON MACHINE CO.
MANCHESTER, CONN.

**FOREIGN AGENTS**

CANADA: Williams & Wilson, 84 Inspector St., Montreal. The Canadian Fairbanks-Morse Co., Ltd., Montreal and Branches. ENGLAND: The Efandem Co., Ltd., 22 Newman St., Oxford St., London, W. 1, Sole Agents for British Isles. AUSTRALIA: Edwin Wood, Ptd., Hardware Chambers, 231 Elizabeth St., Melbourne, Victoria. JAPAN: Andrews & George Co., Takegawa-cho Kiobashiku, Tokyo. SOUTH AFRICA: D. Drury & Co., Main St., Johannesburg. FRANCE: Anciens Etab. Glaenzer & Perreaud, 18 Faubourg du Temple, Paris.

# CARD TAPS

The CARD Quality

## Quick Delivery

**Immediate delivery from stock can now be made on "Card" Hand and Machine Screw Taps.**

"Card" wants your business and you will want "Card" Taps when you know how accurately they are made and the quality of work they will produce. Try them and be convinced yourself—they are good tools.

For sale by leading jobbers in every city.

CARD TOOLS ARE FULLY GUARANTEED

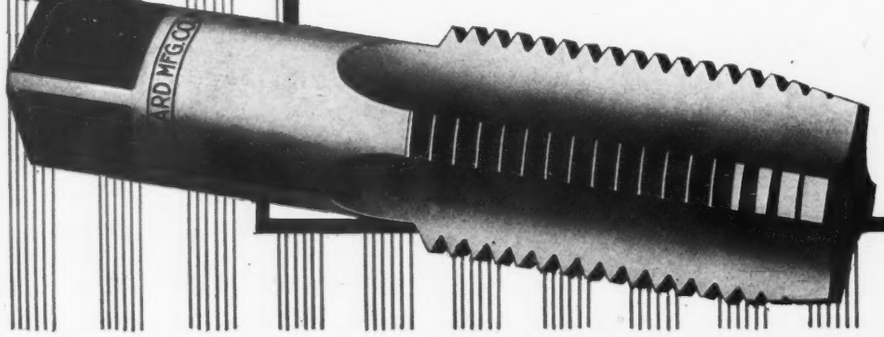
*Catalog 29 Lists Whole Line*

## S. W. CARD MFG. CO.

MANSFIELD MASS., U.S.A.

NEW YORK OFFICE: 62 READE STREET

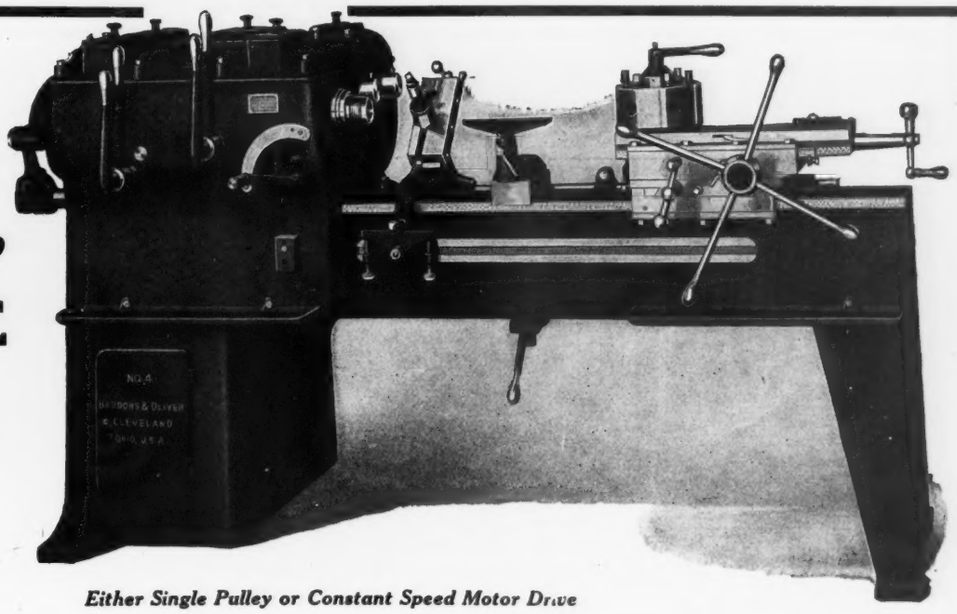
EUROPEAN AGENTS: Chas. Churchill & Co., London, Birmingham, Manchester and Glasgow. Markt & Co., Ltd., Paris. V. Lowener, Stockholm, Copenhagen, Christiania. R. S. Stokvis & Zonen, Ltd., Rotterdam. R. S. Stokvis & Fils, Brussels. Andrews & George, Yokohama, Tokyo, Osaka. J. Lambercier & Co., Geneva. C. Civita, Milano, Italy. R. D'Aulignac, Barcelona, Spain.



*The Advantages of Owning a*

# "FOX" LATHE

*Made by*
**BARDONS & OLIVER**
*of*
**CLEVELAND**



*Either Single Pulley or Constant Speed Motor Drive*

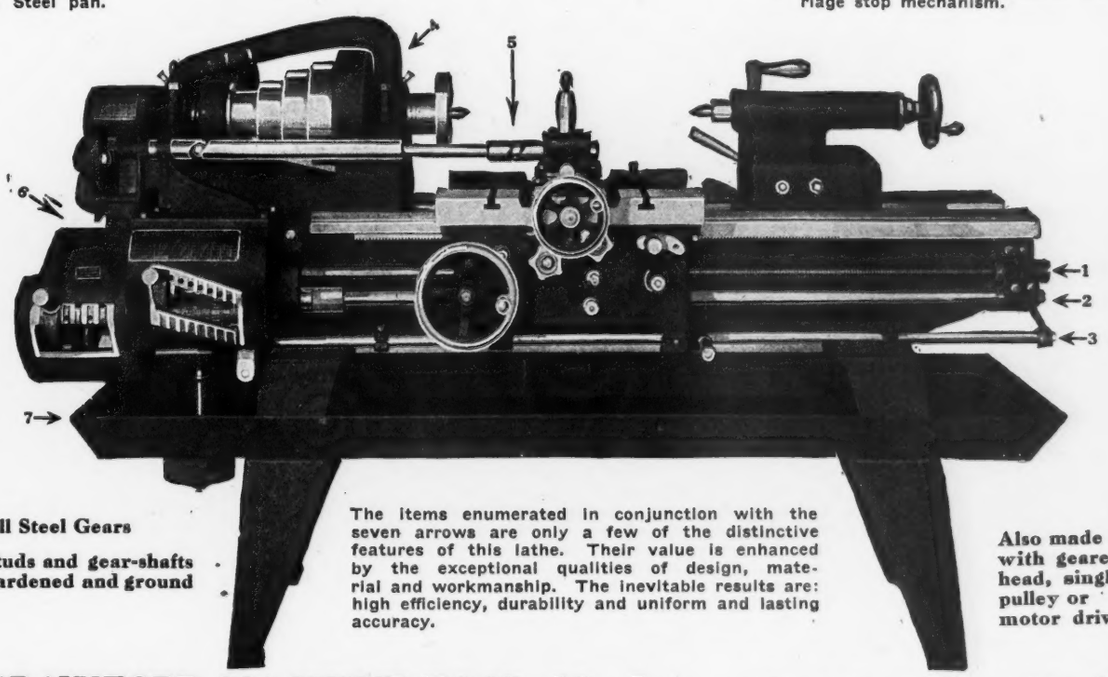
Eight spindle speeds are obtained through geared head; instantaneous reverse from friction clutches, fast running shafts always turning in same direction.

Quick acting chasing attachment, simple taper attachment, universal turret slide and saddle with longitudinal and cross motion are noteworthy features of this lathe.

Automatic chuck, wire feed and power longitudinal feed to turret slide, with which this machine may be equipped, are other factors which account for the unusually wide range of work it is capable of performing. Send for catalog of complete line.

# CRAWFORD 15" TOOL ROOM LATHE

6. Quick-change mechanism. 48 instantaneous thread and feed changes.
7. Steel pan.
4. Tie bar.
5. Relieving attachment.
1. Solid lead screw.
2. Independent feed rod.
3. Apron reverse and automatic carriage stop mechanism.




**All Steel Gears**

**Studs and gear-shafts hardened and ground**

The items enumerated in conjunction with the seven arrows are only a few of the distinctive features of this lathe. Their value is enhanced by the exceptional qualities of design, material and workmanship. The inevitable results are: high efficiency, durability and uniform and lasting accuracy.

**Also made with geared head, single pulley or motor drive**

**CRAWFORD MACHINE TOOL CO., Inc., 21 Park Row, New York**

NATCO

# *"The best possible machine for this class of work"—*

Observe the holes in the Radiator Tanks below. Then look at the picture on the opposite page—36 drills in operation at the same time.

This is one reason why the Production Engineer of the Sterling Motor Truck Company says the NATCO is "the best possible machine for this class of work."

Another reason is that this same NATCO drills 40 holes into the lower section of the Radiator Tank.

325 upper and lower sections, or 12,352 holes $^{11}/_{32}$ inch in diameter, are drilled every ten hours.

And still another reason is that NATCO Multi-Drillers are also Multi-Tappers, Multi-Reamers, Multi-Spot Facers, etc. No matter how many sizes of holes—the NATCO patented multi-speed feature (which provides an independent speed for each individual drill) gives approximately the correct cutting speed for each tool.

***You ought to know the full NATCO story and how it applies to your work. Write us.***

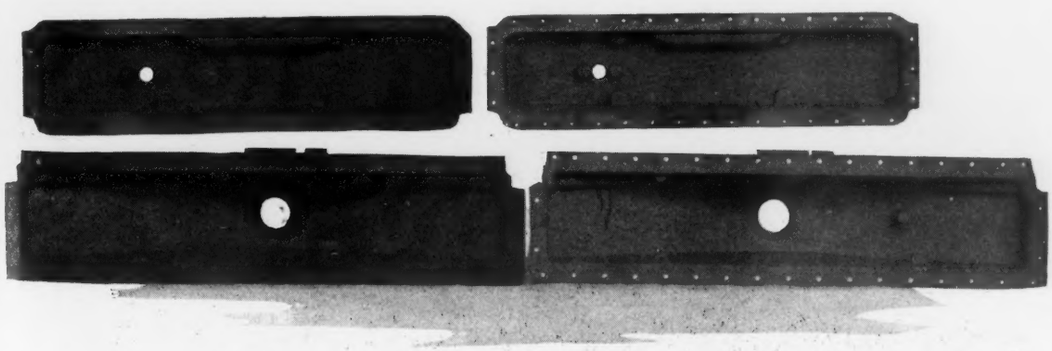
## The National Automatic Tool Company

**RICHMOND** **INDIANA, U. S. A.**

*List of NATCO foreign agents*

Burton, Griffiths & Co., British Isles
E. Isbecque & Co., Belgium
Aux Forges de Vulcain, France

Allied Machinery Co., of America,
Italy, Spain, Portugal and Switzerland



# BARBER-COLMAN
## GROUND HOBS

**B-C HOBS WILL BE YOUR HOBBY**

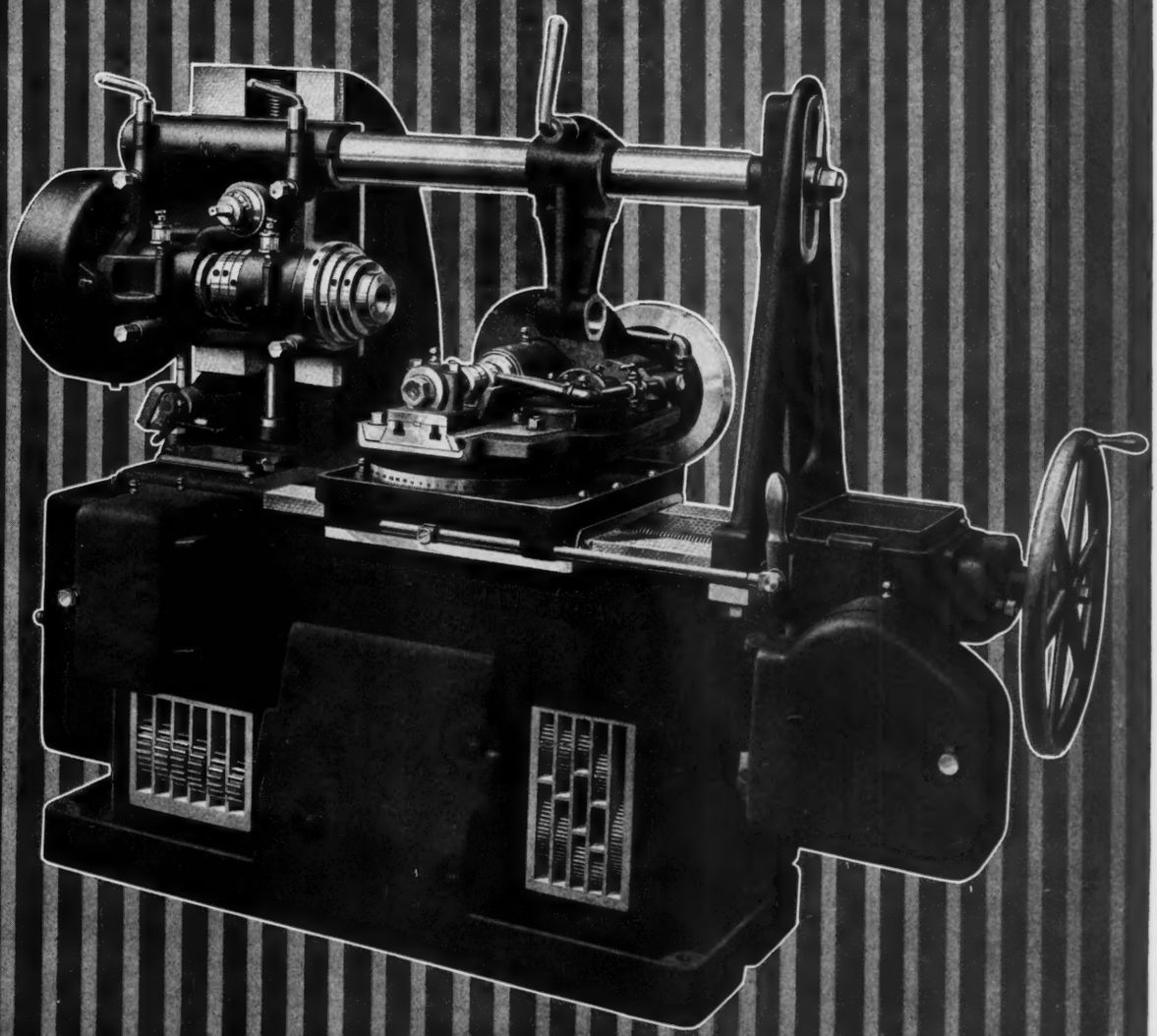
**Where Accuracy and Durability Count Our Hobs Excel.**

**BARBER-COLMAN COMPANY**
**ROCKFORD, ILL. U.S.A.**

# BARBER-COLMAN

## HOBBING MACHINES

ACCURATE
DEPENDABLE



BARBER-COLMAN COMPANY
ROCKFORD ILL U.S.A.

BULLARD

CUTTING TIME BETWEEN CUTS

# 60 MINUTES

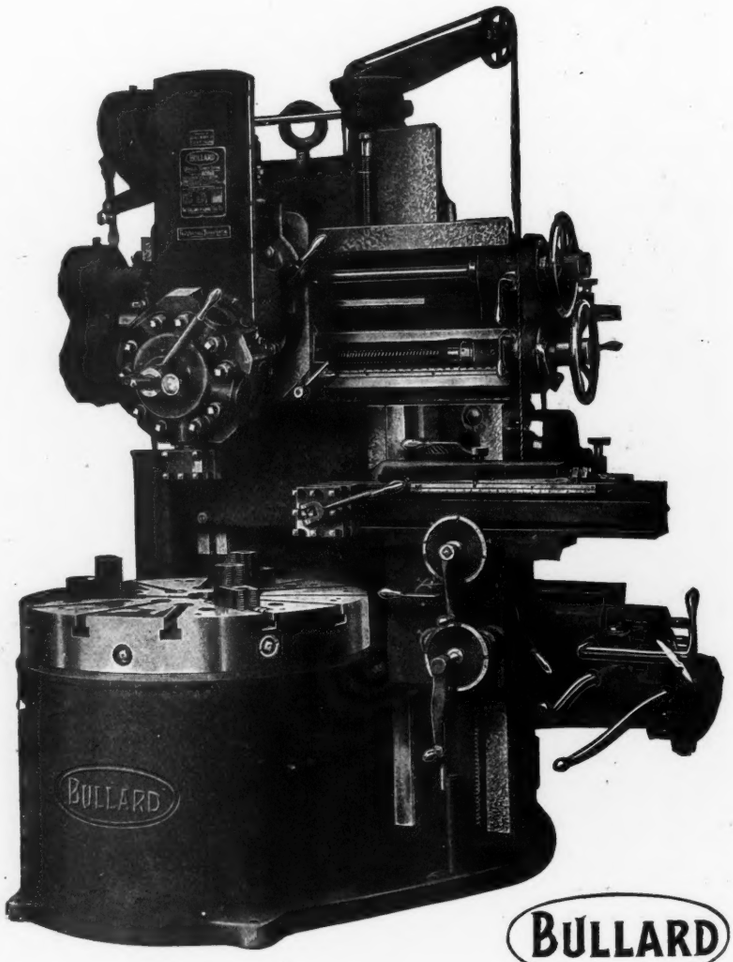
## What Do They Mean in Your Factory?

Do they mean sixty minutes given to actual production, or are half of them wasted in chucking —starting—stopping— changing speeds—hand operating heavy parts?

On the Bullard Vertical Turret Lathe non-productive time is reduced to an absolute minimum.

**Vertical Construction**
**Centralized Control**
**Power Traverse**
**Chrome Nickel Gears**
**Automatic Lubrication**
**Quick Acting Clutch and Brake**
**Observation Stops**
**Hammer Hand Wheels**
**Two Heads Usable Over Entire Range of Machine**

These features make for quick operation — they encourage the operator to greater effort.




BULLARD

# The Vertical Turret Lathe

**24-inch—36-inch—42-inch—54-inch**

## The Bullard Machine Tool Co.

**BRIDGEPORT** **CONN., U. S. A.**

*"You won't have to reduce wages. You won't have to curtail consumption — IF YOU MULTIPLY PRODUCTION"* — Says a Vice-president of a big trust company.

# Multiplying Production is The MULT-AU-MATIC'S Job!

(SIX MACHINES IN ONE)

On one job one Mult-Au-Matic is producing in one hour 80 pieces, where 20 was the former record.

In another plant one Mult-Au-Matic is producing in one hour 40 where 4 was the former record.

In both cases several machines and several men were released for other work.

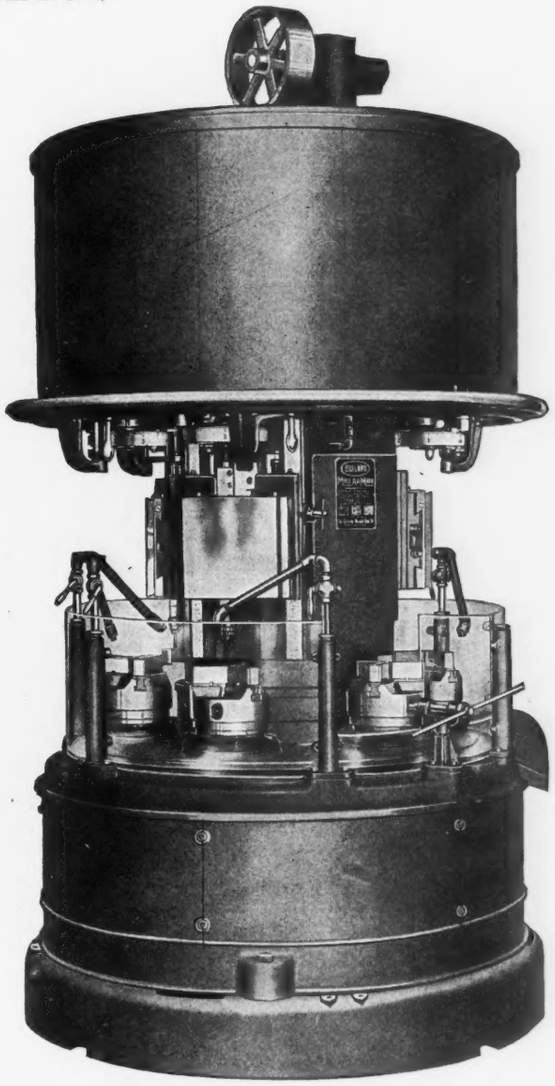
In every case the installation of the Bullard Mult-Au-Matic has resulted in not only *multiplied production,* but the *production of a better finished article.*

The Mult-Au-Matic is six machines in one, and requires but one man to operate it. It requires less investment, less floor space, smaller tool renewal and lower maintenance charges. In principle it is of the automatic Multiple-spindle, or Station Type, but it is different in design and has many original features. Its scope includes all classes of castings, forgings and bar-stock cut to lengths, coming within its capacity, and requiring boring, turning, facing, etc.—operations either singly or in combination.

If you have work to which this machine is adapted, write us for an estimate. Let us *show* you that your costs can be reduced, time saved and overhead cut down. This service places you under no obligation.

**We have a reprint of an interesting article covering this machine. Send for it, and Circular MAM 2-X.**

***MACHINE DELIVERIES ARE GOOD***



## The Bullard Machine Tool Co.

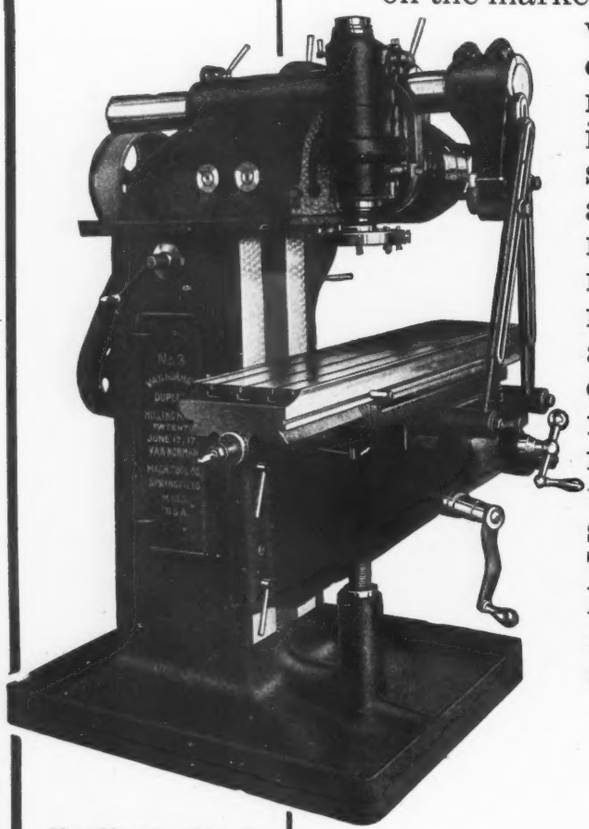
**BRIDGEPORT CONN., U. S. A.**

BULLARD — CUTTING TIME BETWEEN CUTS

BULLARD

# Horizontal and Vertical Milling on the Same Machine

THE Van Norman No. 3 Duplex Miller is the most adaptable and consequently the most economical machine for its work on the market. It does both horizontal and vertical milling—does both as efficiently as a single purpose machine can do either and is quickly changed from one set-up to the other. An adjustable cutter head, which may be set at any angle, permits the simplest forms of end mills to be used for an unusually wide range of work—a construction which, in most instances, does away with the necessity of blocking up work, thus assuring a considerable saving in the cost of fixtures. The Van Norman Duplex Miller is rigid under all conditions and built to endure long, steady service.



Van Norman No. 3 Duplex Miller set for vertical milling

**We'll be glad to send full details upon request.**

# VAN NORMAN

## MACHINE TOOL COMPANY

**WALTHAM AVENUE** **SPRINGFIELD, MASS., U. S. A.**

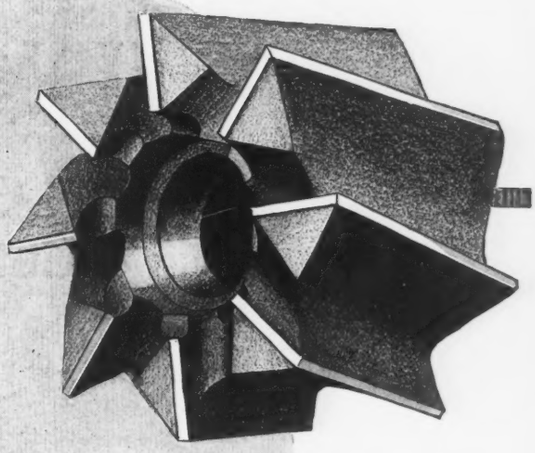
# Vital Values in High-Speed Cutters

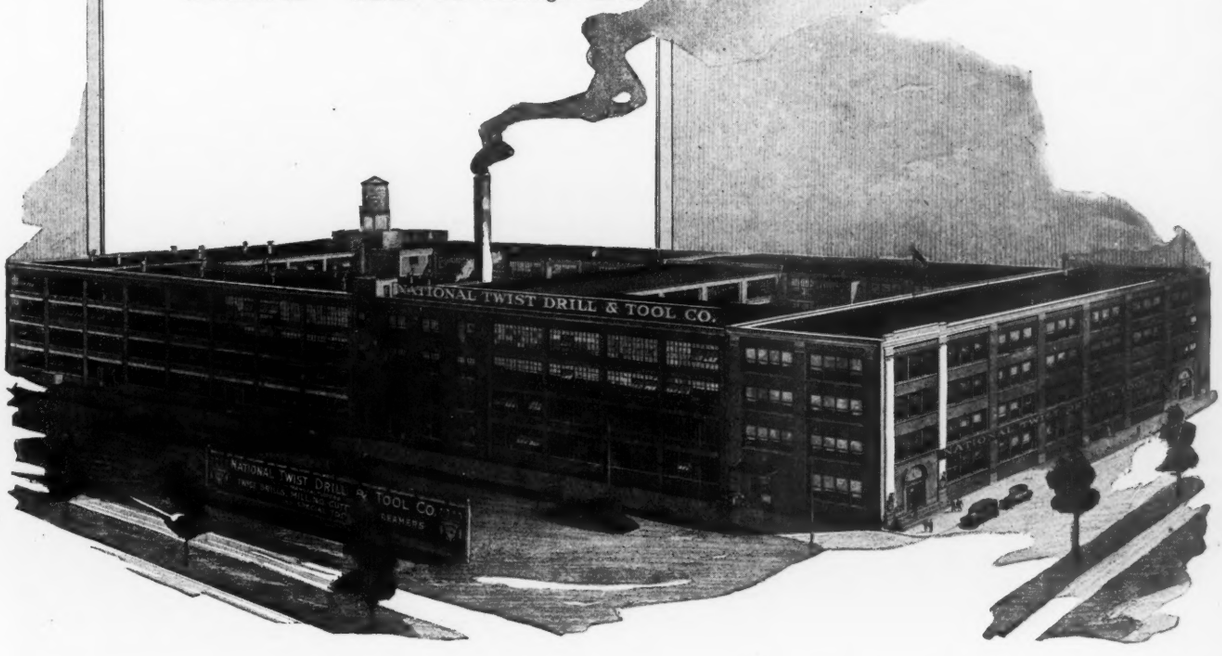
Long wear and lasting worth are the "vitals" of cutter performance. Thousands of National Cutters, Reamers, Twist Drills and Special Tools are winning out in the production drives of American industry, because they are vital-value through and through.

Ask the Expert's opinion of National High-Speed Cutters. You can safely take it for your own.

## National Twist Drill & Tool Co.

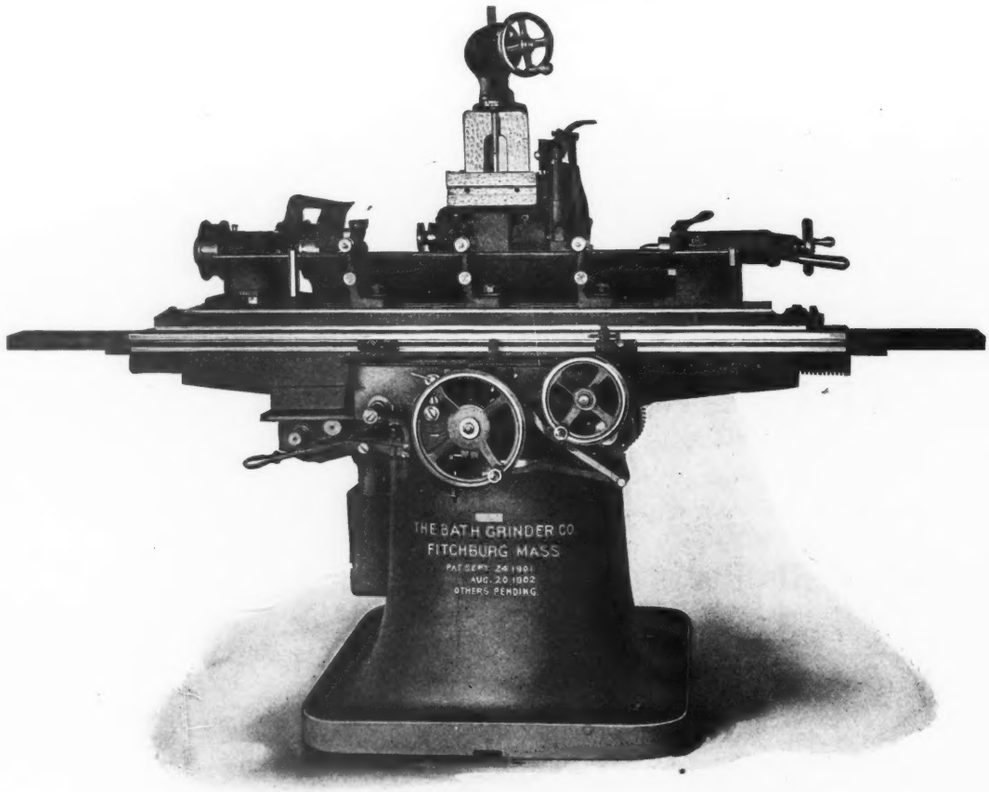
New York Office: 30 Church St. DETROIT U. S. A. Chicago Office: 565 Washington Blvd.





# BATH UNIVERSAL GRINDING MACHINE

## For Cylindrical, Surface, Internal, Tool and Cutter Grinding




*MADE IN 3 SIZES*

No. 1. 10" Swing, 20" between centers, Wheel 10x ¾
No. 2. 10" Swing, 25" between centers, Wheel 12x1½
No. 2½. 10" Swing, 36" between centers, Wheel 12x1½

BUILT BY

## UNIVERSAL GRINDING MACHINE COMPANY

### FITCHBURG, MASSACHUSETTS, U. S. A.

AGENTS: The Fairbanks Co., New York City, Albany, Syracuse, Utica, Buffalo, Boston, Hartford, Newark, Philadelphia, Scranton, Baltimore, Birmingham, Ala., New Orleans. The Chas. A. Strelinger Co., Detroit. The E. L. Essley Mchy. Co., Chicago. The W. M. Pattison Supply Co., Cleveland. The National Supply Co., Toledo. Laughlin-Barney Mchy. Co., Pittsburgh. Brownell Mchy. Co., Providence. Hallidie Machinery Co., Seattle. W. H. Savage, Fitchburg. Alfred Herbert, Ltd., Coventry and Yokohama. George E. Fogarty, Paris. Nielsen & Winther, Copenhagen. American Machinery Syndicate, New York and Barcelona, Spain. R. S. Stokvis & Zonen, Holland.

# P. W. V.
# AUTOMATIC MACHINE CORPORATION

## FITCHBURG, MASS.

Detroit Office: C. M. TRIPP, Manager, 74 Brush Street

August, 1919

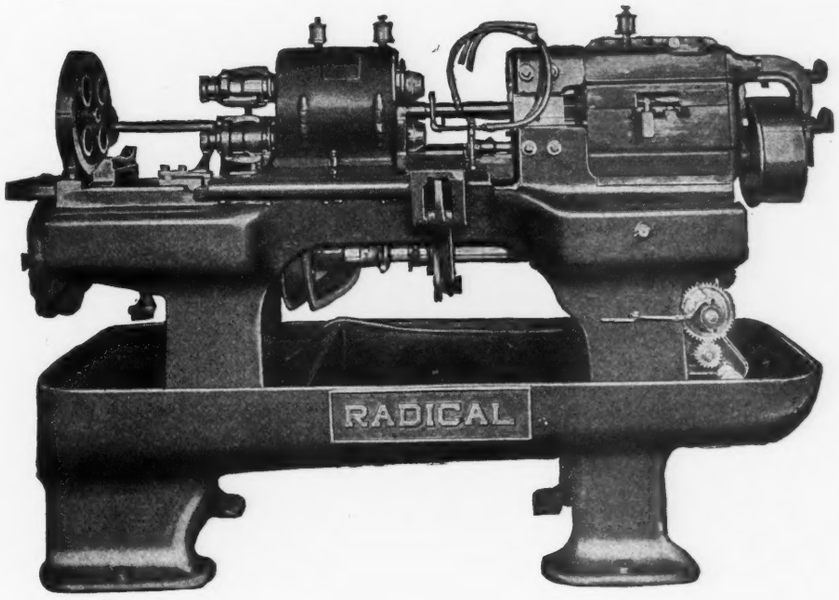
Mr. Screw Machine Man.

If you have never investigated the RADICAL Automatic we can understand how it seems almost incredible to you that the RADICAL Threading Cam is never changed or adjusted and how the possibility of threading in either the third or fourth positions or both or neither sounds like a dream.

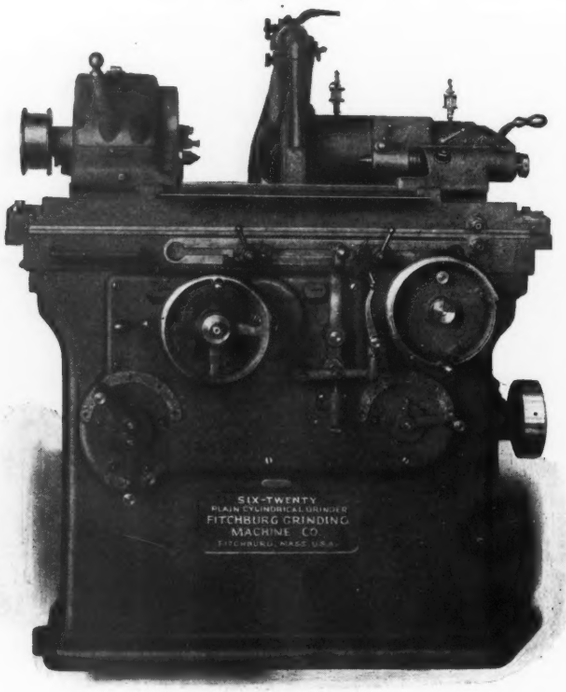
Spring, Button or Self Opening Dies—Right or Left Hand Threads, and the threading cam is never changed—no cam strips—It's RADICAL and It's RIGHT.

Radically yours,

P. W. V.

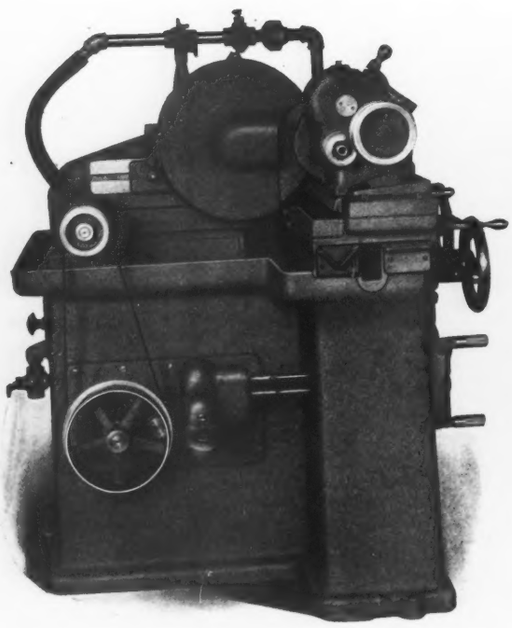


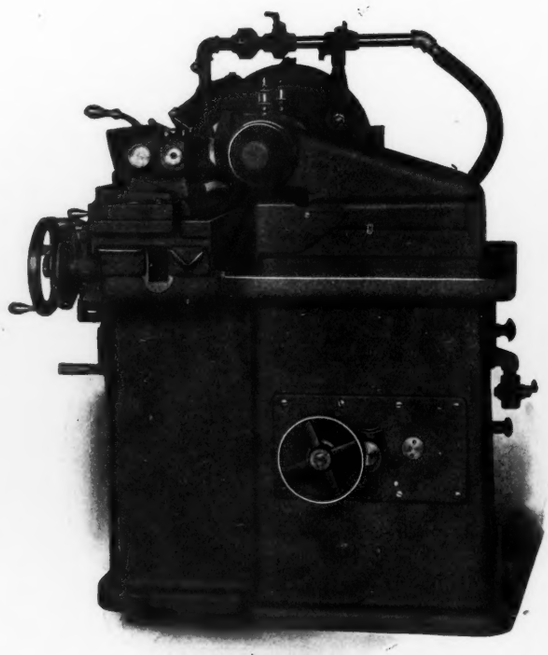

## THE RADICAL AUTOMATIC




# Fitchburg Grinder

## Model "A" 6 x 20 in.



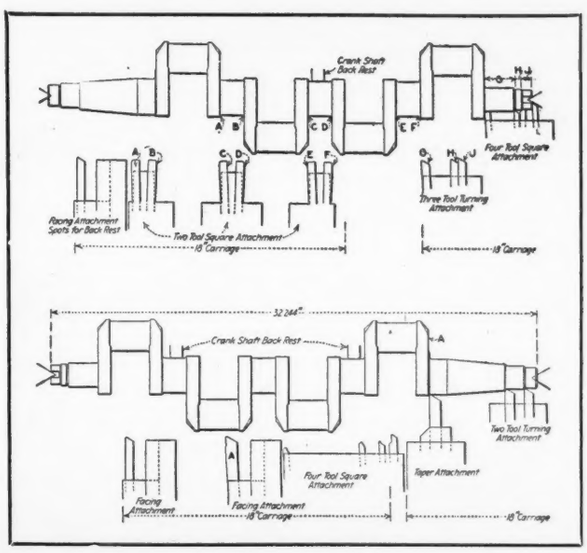


## FITCHBURG GRINDING MACHINE COMPANY

FITCHBURG, MASS., U. S. A.

# So-swing
## MULTIPLE TOOLED LATHE

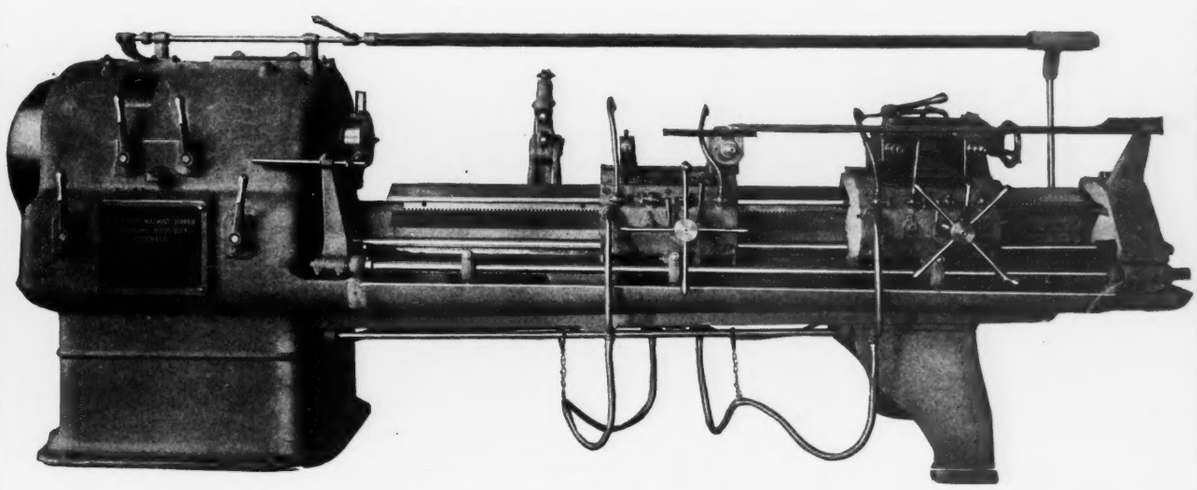
## The Lathe for Machining Crank Shafts




FOR machining crank shafts, cam shafts, axles, gear shafts, machine spindles, drive shafts, etc., the *So-swing* Multiple Tooled Lathe is in a class by itself. The sketch on this page illustrates the first and second operations on a crank shaft as performed on the 8" *So-swing*. Ends and main line bearings are turned and shoulders squared down.

*So-swing* practice reduces operating time where there are a number of diameters to be turned to the time required for the longest individual cut. It is the most economical method wherever it may be used—and it may be used on a wide range of work.

***Send for booklet—"The So-swing Lathe at Work." It may solve some of your production problems***



**FITCHBURG MACHINE WORKS**

**FITCHBURG** **MASS., U. S. A.**

## Linde Oxygen is the Breath of Life to the Oxy-Acetylene Flame

In the manufacture of metal products—in the erection of metal structures—for the repair of broken or worn metal parts in all industries—

The supremacy of the oxy-acetylene welding and cutting flame is established.

## Linde Oxygen is a Vital Element in this Supremacy

Linde Oxygen is distributed from 65 stations, located for serving all users according to their needs—1000 cylinders, or 1, as the case may be. The Linde Organization is so big, any customer's sudden increase or shrinkage in oxygen consumption is instantly absorbed as a mere incident in the day's work.

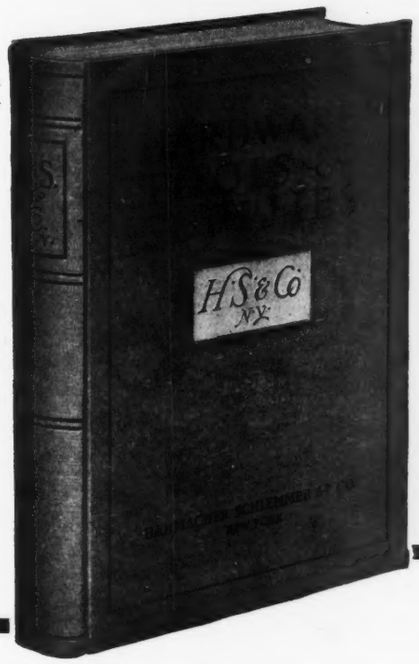
219

**The Linde Air Products Company**

*Largest Producer of Oxygen in the World*

30 East 42d Street, New York

Kohl Building, San Francisco




WHEN YOU WANT

# TOOLS HARDWARE AND SUPPLIES

First you need our large catalog showing a full line of Bolts, Screws, Nuts, Washers, Rivets, Burrs and a full assortment of Tools, including Drills, Files, Reamers, Taps, Dies, Wrenches, Hammers, Pliers, etc., etc. During the past few years' "rush" many very large concerns have found our stock a most handy source for large and varied assortments of staple supplies.

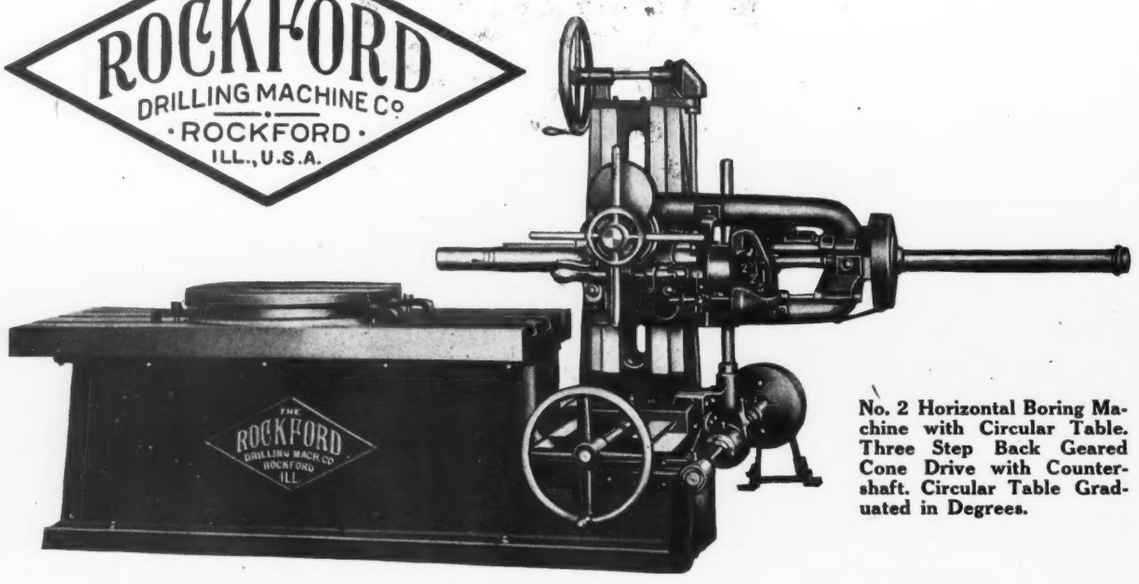
**For 71 years** we have been handling this line, and during this period our hobby has been Quality. In your dealings with us you will have the satisfaction of knowing that you are getting the best the market offers and at lowest current rates consistent with quality.

***In corresponding about catalog please mention Catalog No. 198***

**HAMMACHER, SCHLEMMER & CO.**

**NEW YORK SINCE 1848** **4th Avenue and 13th Street**

THE ROCKFORD DRILLING MACHINE Co. · ROCKFORD · ILL., U.S.A.



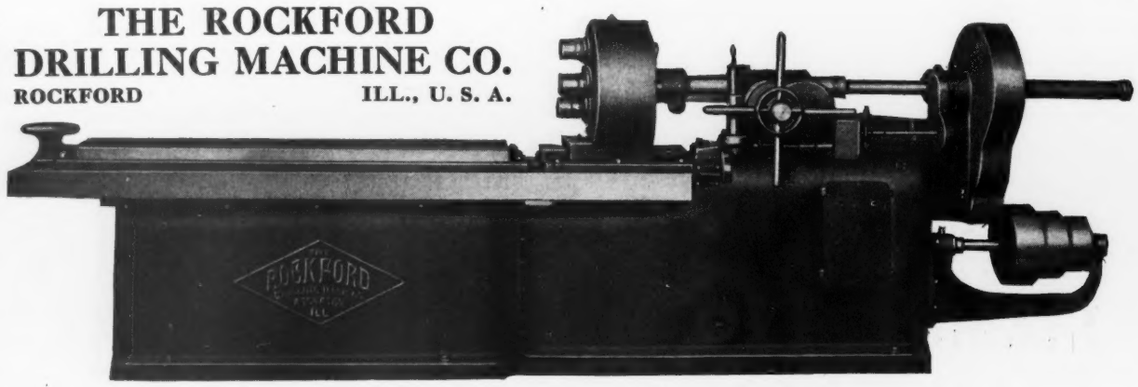
No. 2 Horizontal Boring Machine with Circular Table. Three Step Back Geared Cone Drive with Countershaft. Circular Table Graduated in Degrees.

# Manufacturers! Here Are Two Developments That Will Interest You

The circular table with its graduations in degrees is a great aid to speed and precision in the boring of holes that are either regularly or irregularly spaced on two or more sides of any piece of work; makes the Rockford Horizontal Boring Machine a precision manufacturing tool; also saves a remarkable amount of time on a great variety of tool room work. We'd like to tell you more about Circular Table advantages.

The Four Spindle Rockford Boring Machine is a single purpose manufacturing tool developed especially for gas engine crank case boring operations. Bores the four holes simultaneously, accurately and speedily. A machine which is built up to the Rockford standards —carefully proportioned—selected materials — excellent workmanship. Let us send complete description of this and other Rockford machines.

**THE ROCKFORD DRILLING MACHINE CO.**
**ROCKFORD ILL., U. S. A.**



Heavy Duty Horizontal Boring Machine with Four Spindle Drive Head and Index Plate. For Boring Four Holes in Automobile Crank Cases at One Time.

# AJAX

(Trade Mark Registered)

## HOT METAL WORKING MACHINES

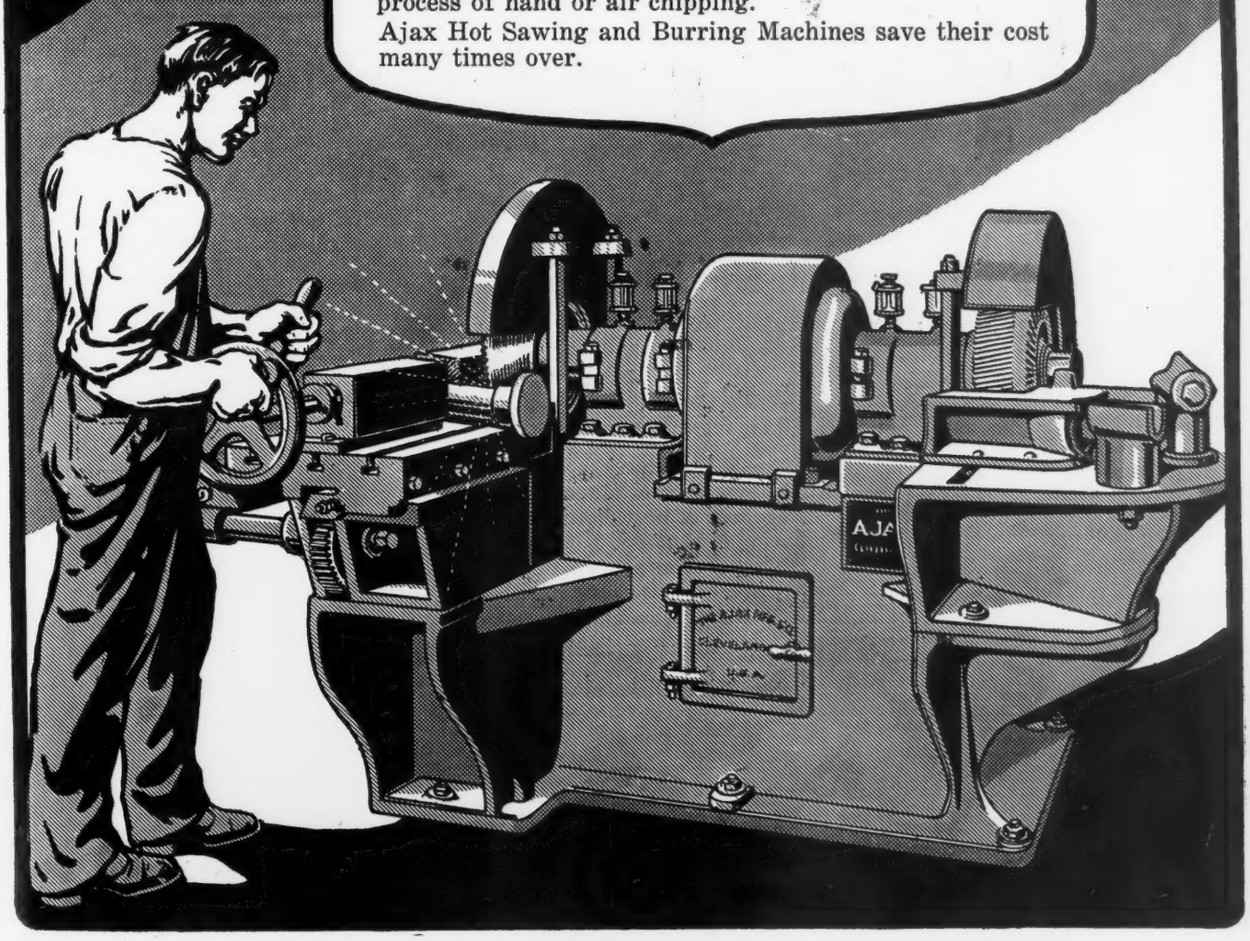
## Hot Saw and Burring Machine

Ajax Hot Sawing and Burring Machines are recognized as essential accessories in the modern forge shop, especially where upsetting machines are used.

The Hot Saw enables forgings which must be produced on an upsetting machine, but which have no shank for tong hold, to be upset on the end of a bar of stock and then sawed off while still at forging heat.

Hot sawing is also used for splitting hot bar stock for making jaw forgings, etc., ready for upsetting. Flashes and fins can be removed from forgings in a few seconds on the burring wheel attachment instead of by the slow process of hand or air chipping.

Ajax Hot Sawing and Burring Machines save their cost many times over.



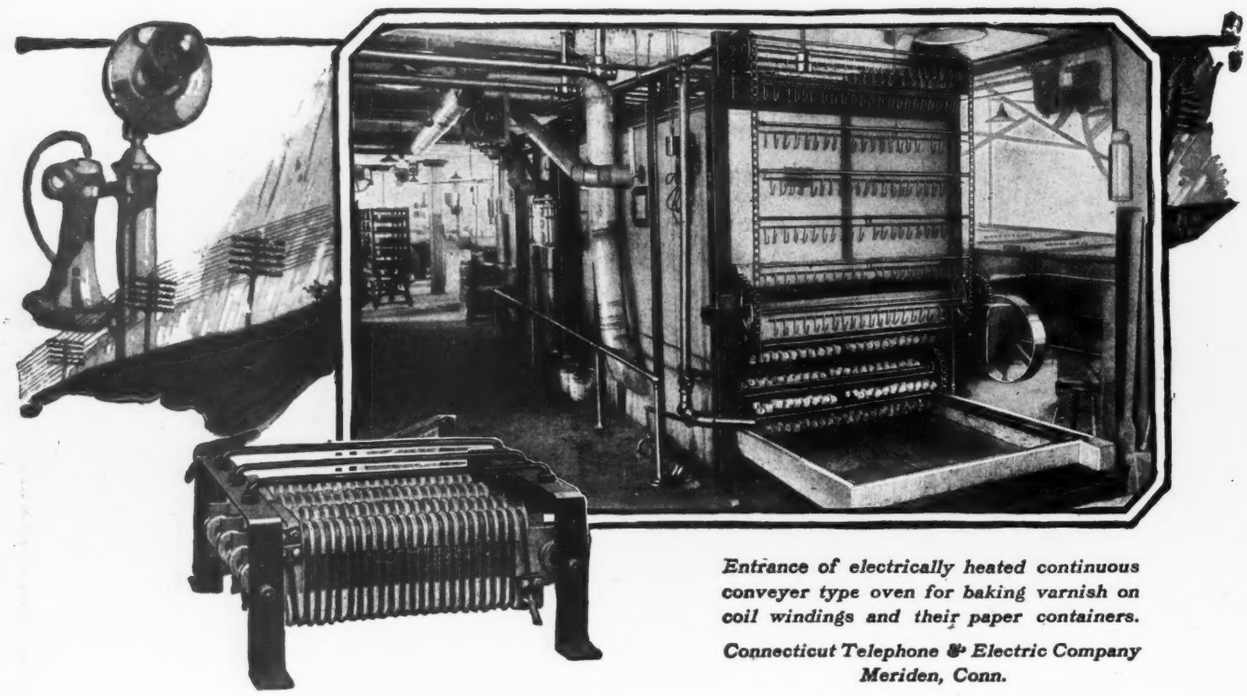
## THE AJAX MANUFACTURING CO.

621 Marquette Building
CHICAGO, ILL.

CLEVELAND, OHIO

1369 Hudson Terminal
NEW YORK CITY

*The cheapest method of heating is that which reduces to a minimum the total cost of a satisfactory product.*



*Entrance of electrically heated continuous conveyer type oven for baking varnish on coil windings and their paper containers.*

*Connecticut Telephone & Electric Company*
*Meriden, Conn.*

## Baking Varnish the Modern Way

FROM the coils to the housing box electric heat plays an important part in the manufacture of telephone instruments.

The oven as shown has been in operation for over three years and has proven all claims made for it, such as

Increased production
Absolute control of temperature.
Evenness of heat distribution
Saving of time and labor
Saving of floor space
A perfect finish every time
Practical elimination of rejects.

The electric way is the modern way—the proven economical way.

*Send for Bulletin 48021-A*

**General Electric Company**

General Office Schenectady, N.Y.

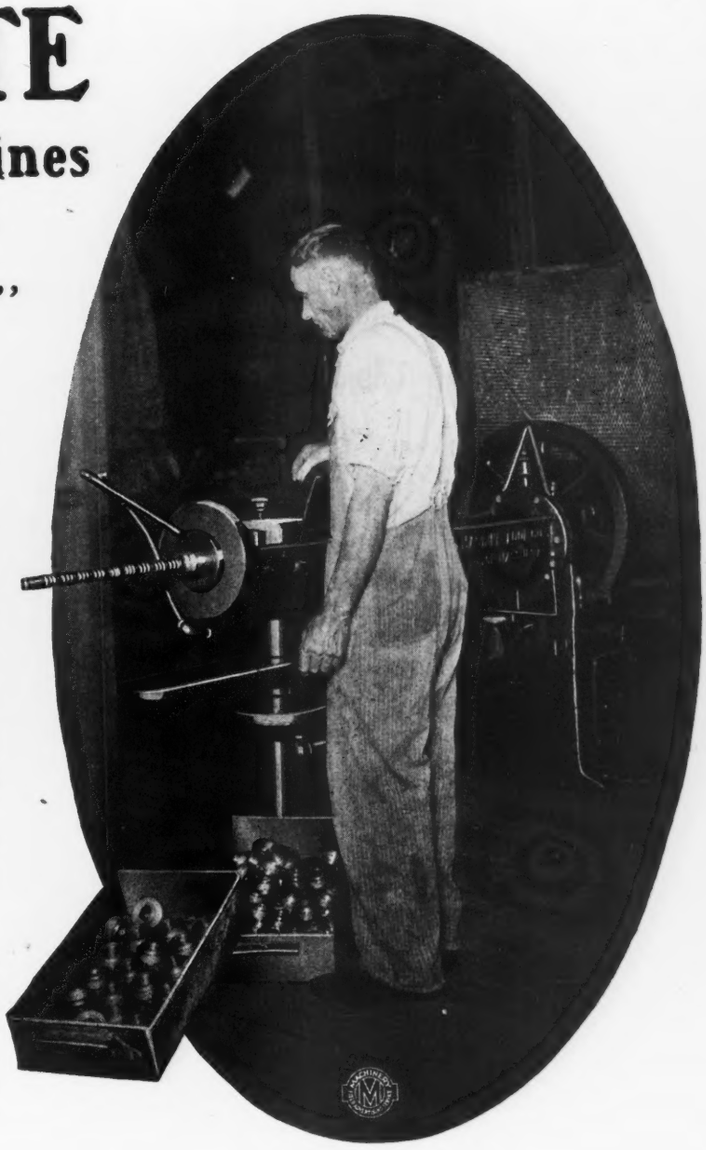
39-22

# LAPOINTE

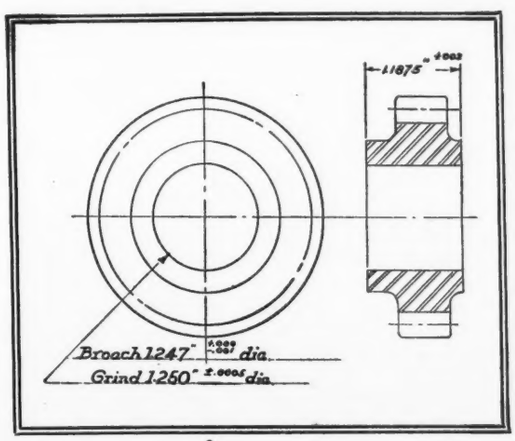
## Broaching Machines Do the Work

### *The "Man from Hudson" Tells the Story*

It was a case of Broaching vs. Reaming in the shops of the Warner Gear Co. (Muncie, Indiana) when they installed their first Lapointe Broaching Machine seven years ago. The case had been settled when this photograph was taken recently, for *five* Lapointe Broaching Machines were doing, with greater economy of time and labor and the certainty of accuracy, all the work that had formerly been finish reamed.



**The photograph shows one of these machines broaching mild steel gears; an average of .010" stock is removed, and they are finished to plus .000" and minus .001" at the rate of 69 per hour.**




Lapointe Broaching Machines cut costs wherever they can be used to supplant more complicated methods and machines; simple in construction and use, they offer the most practical and economical means of duplicating round, square or irregular holes of all descriptions.

***If you are interested write us. Let the "Man from Hudson" give you details on work that parallels yours***

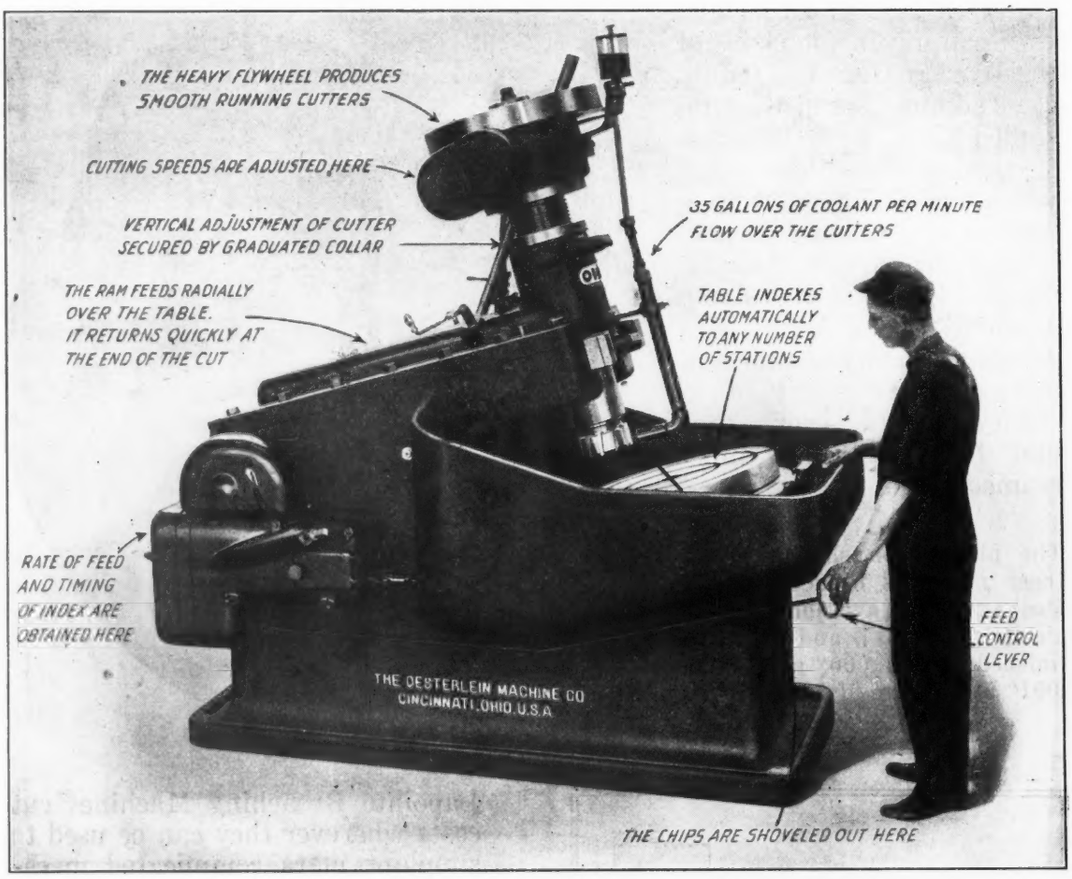
## The Lapointe Machine Tool Company

**Hudson** **Massachusetts, U. S. A.**

# The Champion Comment of the A. R. S. M. Convention

A convention crowd will express its sentiment—and there is always a man in the crowd who finds the best way to WORD their sentiment. We voted the championship to the man who, after watching the Ohio Tilted Rotary clip off production time, chose this English—

**"When Oesterlein Tilted the Table, They Upset Previous Production Records"**



*Os. Terlein Says:— The tilted table permits of cooling the cutter with 35 gallons of lubricant per minute —while the operator does his work in dry territory.*

**SPECIFICATIONS**

**Swing—40 inches. Diameter of table—30 inches. Inclination of table—15°. Taper of spindle—No. 16 B. & S. Weight of flywheel—300 pounds. Area of table bearing—475 square inches. Area of ram bearing—1,000 square inches. Automatic operation. Belt or motor drive. Table capable of continuous feeding or of indexing to stations. Weight—11,000 pounds.**

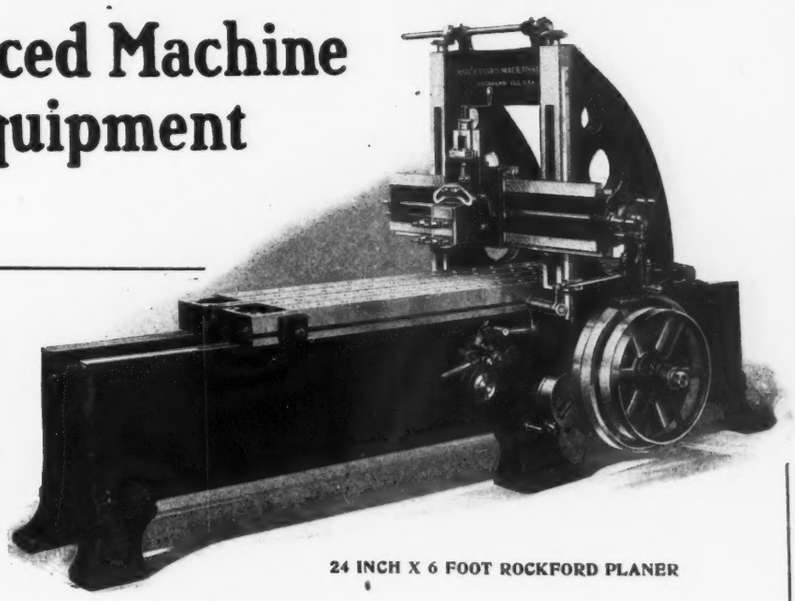
## THE OESTERLEIN MACHINE COMPANY

CINCINNATI MILLERS OHIO GRINDERS OHIO, U. S. A.

# ROCKFORD

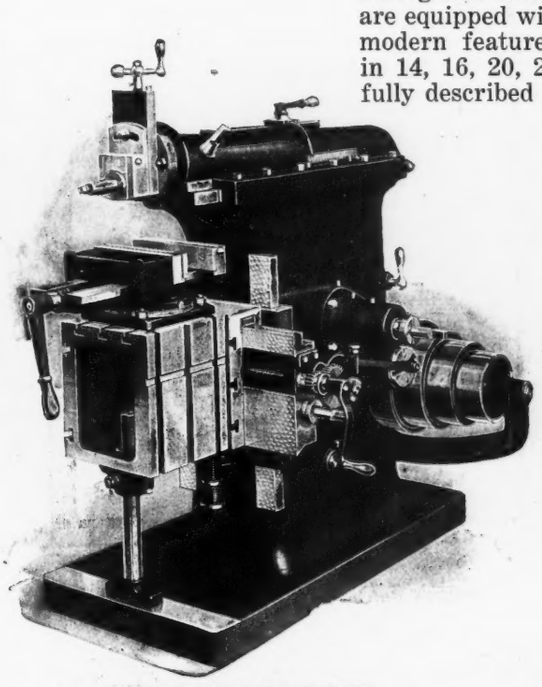
## Well Balanced Machine Tool Equipment

Rockford Planers are heavy and powerful tools of the most modern design. They are rapid and convenient to operate, and will reduce manufacturing costs in any shop. In sizes from 24″ to 54″ with any desired length and head equipment.



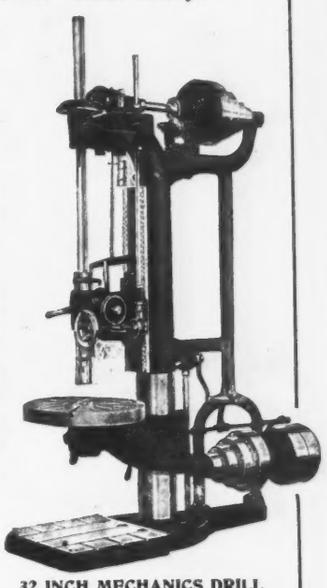
24 INCH X 6 FOOT ROCKFORD PLANER

Rockford Shapers will handle a wide range of manufacturing and tool room work accurately and rapidly. They are equipped with taper gibs throughout, and many other modern features will be found in their design. Built in 14, 16, 20, 24 and 28″ sizes. Rockford Shapers are fully described in the circulars. Ask for them today.



16 INCH ROCKFORD SHAPER

Mechanics Drills are made in sizes 14 to 36″ standard machines, and gangs with any required number of spindles. A wide range of speeds and feeds adapts them to the work whether it is light or heavy.



32 INCH MECHANICS DRILL

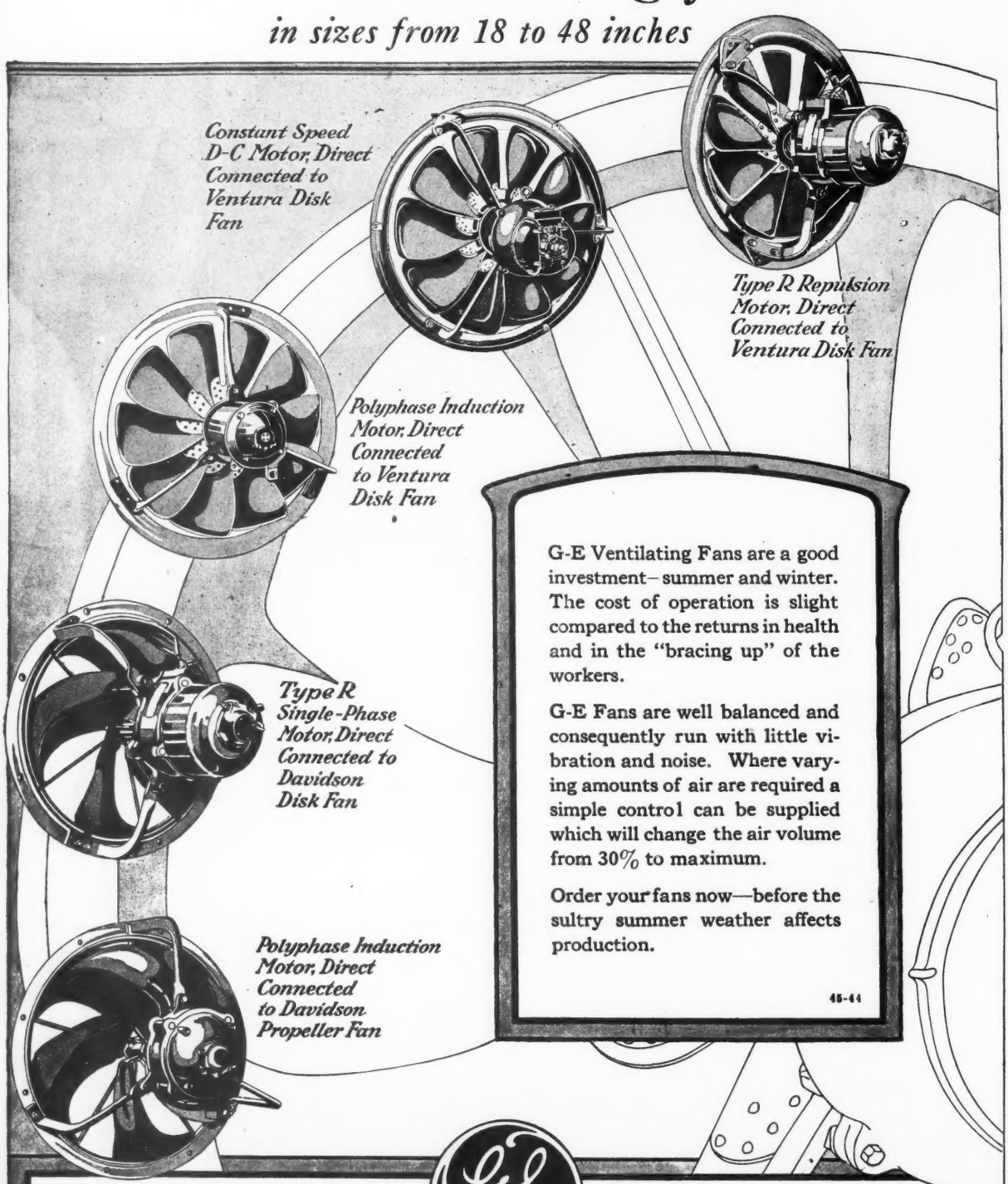
**If you are equipping a new plant, get informed on the whole line, and learn how Rockford Tools will increase your facilities**

## ROCKFORD MACHINE TOOL CO.

**ROCKFORD** **ILL., U. S. A.**

# G-E ventilating fans

*in sizes from 18 to 48 inches*



*Constant Speed D-C Motor, Direct Connected to Ventura Disk Fan*

*Type R Repulsion Motor, Direct Connected to Ventura Disk Fan*

*Polyphase Induction Motor, Direct Connected to Ventura Disk Fan*

*Type R Single-Phase Motor, Direct Connected to Davidson Disk Fan*

*Polyphase Induction Motor, Direct Connected to Davidson Propeller Fan*

G-E Ventilating Fans are a good investment—summer and winter. The cost of operation is slight compared to the returns in health and in the "bracing up" of the workers.

G-E Fans are well balanced and consequently run with little vibration and noise. Where varying amounts of air are required a simple control can be supplied which will change the air volume from 30% to maximum.

Order your fans now—before the sultry summer weather affects production.

45-44

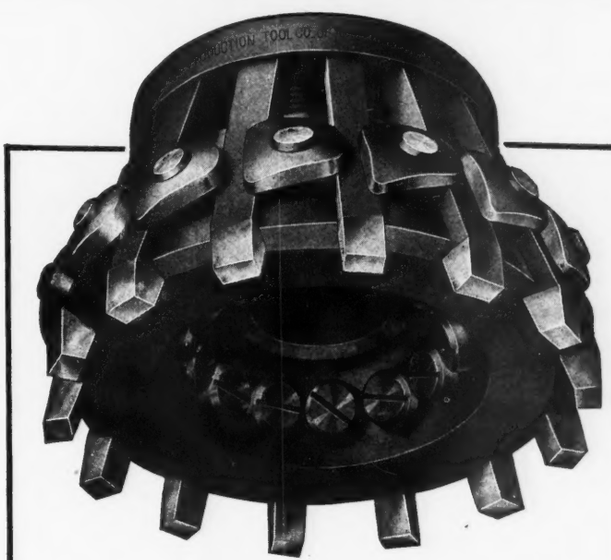
**General Electric Company**

General Office Schenectady, N.Y.

Sales Offices in all large cities

"FOR PRODUCTION USE PRODUCTION TOOLS"

# Less Speed—More Feed



"PRODUCTION"
Surface Milling Cutters
More Than Double Production

| FREE CUTTING | LONG LIFE | LESS GRINDING |
|---|---|---|

*Send for Descriptive Circular*

## Production Tool Company of America

DETROIT

Manufacturers of
"Production" Surface Milling Cutter
"Production" 2 Lip Spotfacer

MICHIGAN

*Model 1AD Hand Drill*

## MODEL 1AD Hand Drill

**Length**—10 inches.

**Weight**—4¾ pounds.

**Capacity**—Steel, brass, aluminum and alloys, 0 to $\frac{3}{16}$ inches.

**Motor**—Universal, operates on either direct or alternating current. Diameter of motor 3⅜ inches.

**Spindle**—Offset from center $\frac{25}{32}$ inches.

**Drive**—Helical gears.

**Handle**—Aluminum. Complete with 10 foot cord, plug, switch and chuck. Jacobs chucks used as regular equipment.

## MODEL 2AD Sensitive Drill

**Height**—18 ins. **Weight** 18 lbs.

**Stroke**—3¼ ins. **Feed**—Rack and pinion. Helical gear drive.

**Capacity**—Steel, brass aluminum and alloys, 0 to $\frac{3}{16}$ inch. Drills to center of 7½ inch piece.

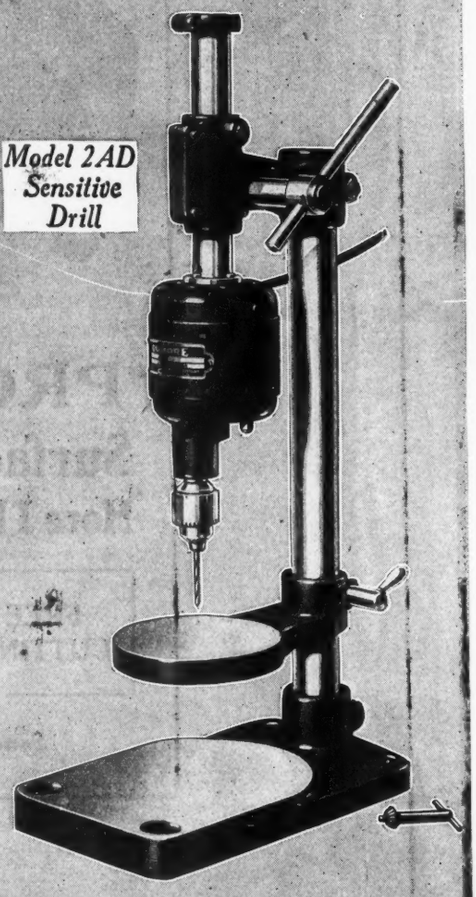
**Motor**—Universal, operates on either direct or alternating current. **Diameter**—3⅜ inches.

**Spindle**—Offset from center $\frac{25}{32}$ inches.

**Thrust**—Ball bearing.

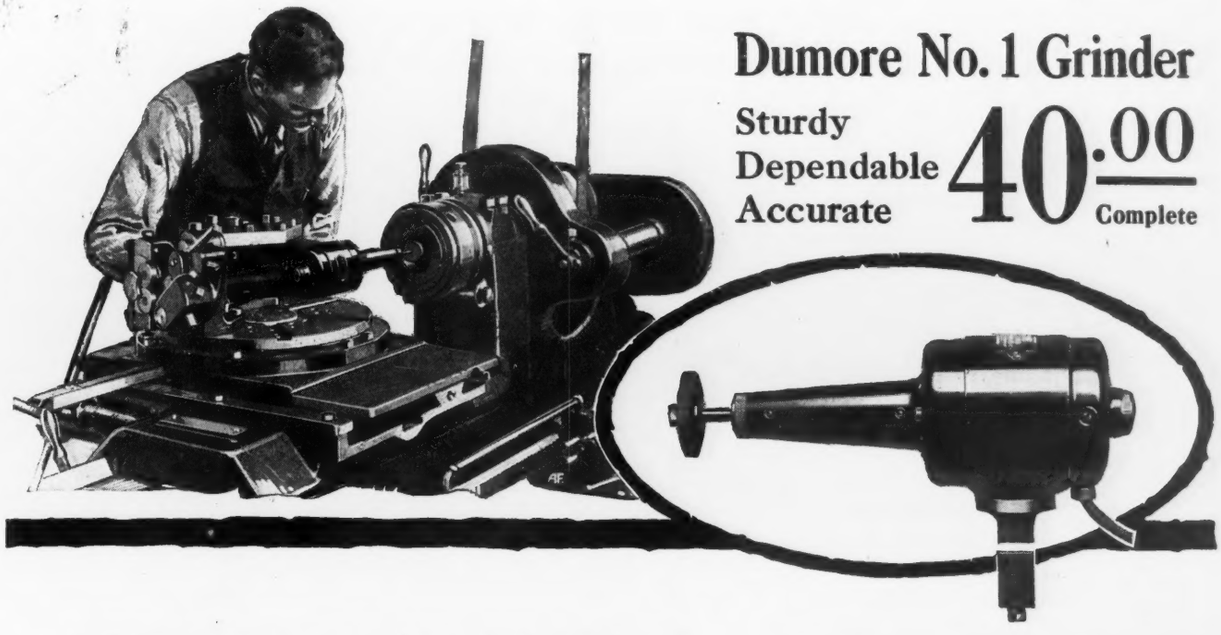
**Table**—Adjustable, may be raised, lowered or swung entirely out of the way. Complete with 10 foot cord, plug, switch and chuck. Jacobs chucks used as regular equipment.

**Wisconsin Electric Company**
**2514 Sixteenth Street, Racine, Wis.**



*Model 2AD Sensitive Drill*

# DUMORE GEARED ELECTRIC DRILLS



# Dumore No. 1 Grinder

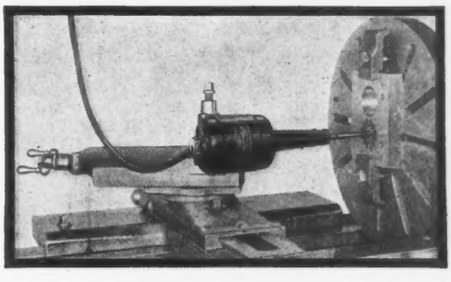
Sturdy
Dependable
Accurate

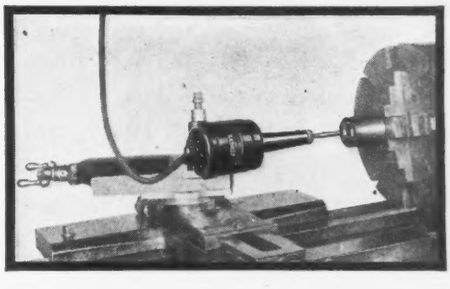
**40.00** Complete

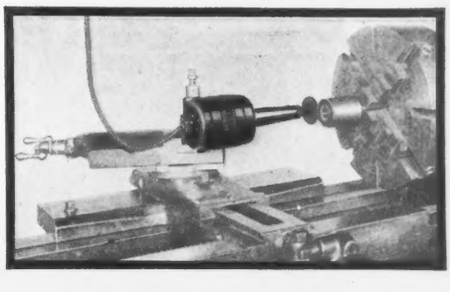
THERE is no doubt of the value of the **Dumore No. 1 Grinder.** No other tool, at or anywhere near its price, can give a greater amount of actual, accurate daily service.

Because jigs, dies, gages, bushings, etc., will always warp during tempering, thousands of mechanics use the **Dumore** grinder to bring these tools to as close limits as .0001". Such a degree of accuracy is possible solely because the **Dumore** is perfectly balanced throughout and operates at the correct cutting speed.

We have some very interesting literature for men facing grinding problems —write for it.



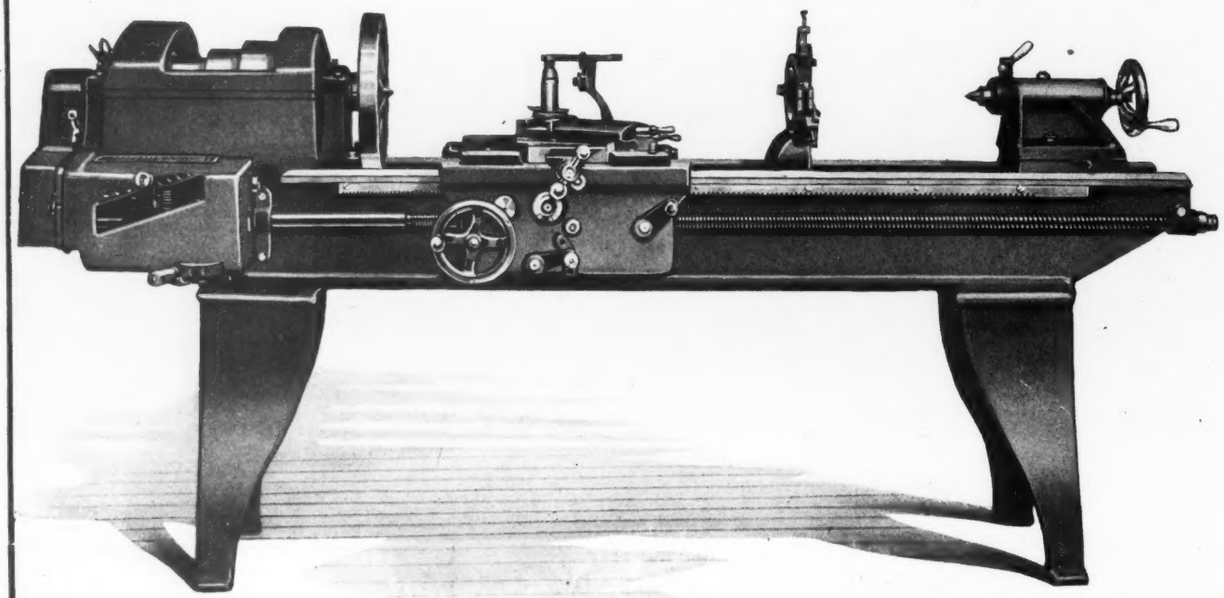


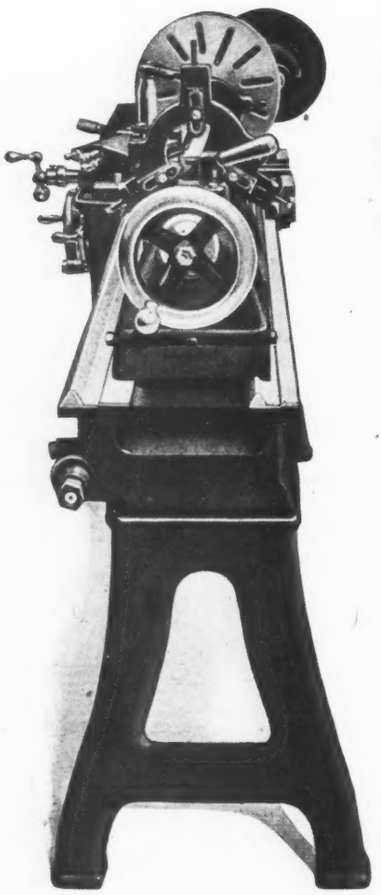


**WISCONSIN ELECTRIC COMPANY**
2514 SIXTEENTH STREET
RACINE, WIS.

# DUMORE HIGH SPEED GRINDERS

THE SIDNEY MACHINE TOOL COMPANY





# A New Light Pattern SIDNEY LATHE

## With Many Exclusive Features

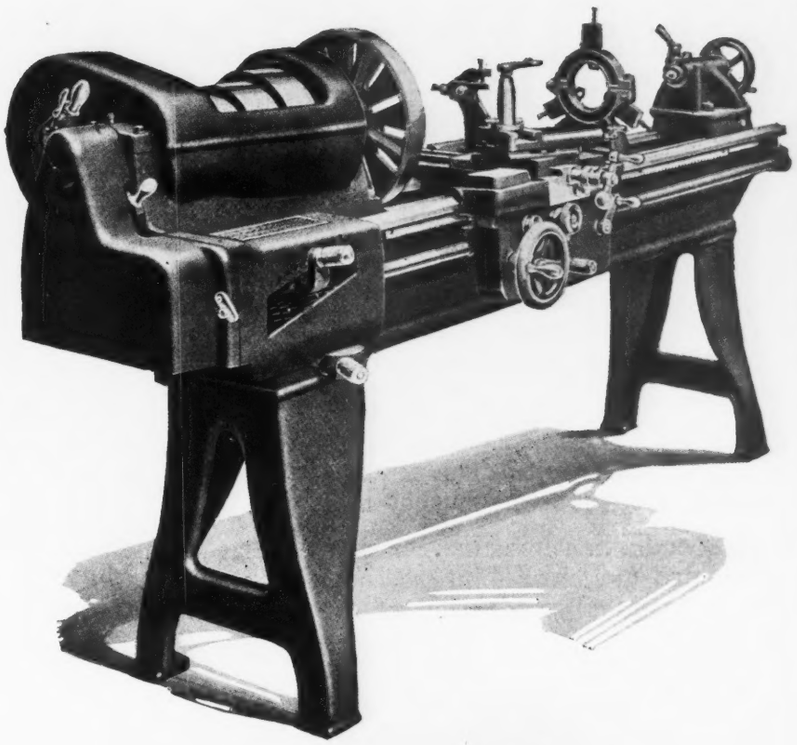
We are now building a light pattern lathe in 14″, 16″, 18″ and 20″ swings, with any length beds desired from 6′ up. These machines are built with either semi-quick change or quick change gear boxes. We are using steel gears in the apron, steel gears in the gear box, and in fact, steel gears throughout. The bed of the lathe has a 20 per cent steel mixture in the V's, assuring very hard surface, confining all of the wear to the carriage. The head and tail stock spindles are turned from 50-point carbon steel, and the headstock spindle runs in large bearings lined with an 80, 10 and 10 composition of phosphor bronze, which is self-oiling by rod feed oil cups.

THE SIDNEY MACHINE TOOL COM

# THE SIDNEY MACHINE TOOL COMPANY

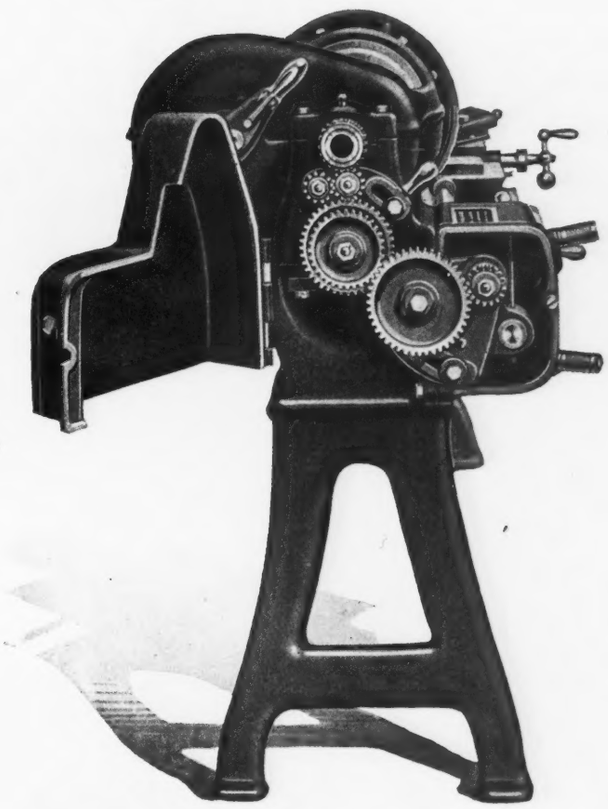
## THIS New Sidney Lathe

is designed along the most modern and up-to-date lines, to handle medium heavy production work as well as tool room work. It is built to limits of one thousandth part of an inch throughout, and is guaranteed for workmanship and accuracy with the strongest guarantee possible on a machine tool.



## Quick Change Gear Box

The quick change gear box is attached to the bed to a recess provided for it, and covers a wide range of thread cutting and feeding. The gears are of coarse pitch and wide face, and are entirely shielded from grit and dirt. A swinging cover at the end of the bed affords easy access to the gear train from the spindle down to the gear box, and this single swinging cover is common to both the quick change gear and semi-quick change gear lathes.



***The specifications of this lathe will interest you. Send for the new circular.***

# PANY, SIDNEY, OHIO, U. S. A.

# The "General Electric" Demands Efficient Service

The large number of W & P Planers in use by the G. E. Co., in their Schenectady plant is sufficient to indicate their opinion of these machines.

The one shown—a 48″ x 48″ x 12′ Planer—was installed in the induction motor department in 1917 and is used for machining iron castings—being driven by a 15 H.P. General Electric Reversing Motor which operates at a minimum speed of 250 R.P.M. on the cutting stroke and a maximum speed of 1,000 R.P.M. on the return.

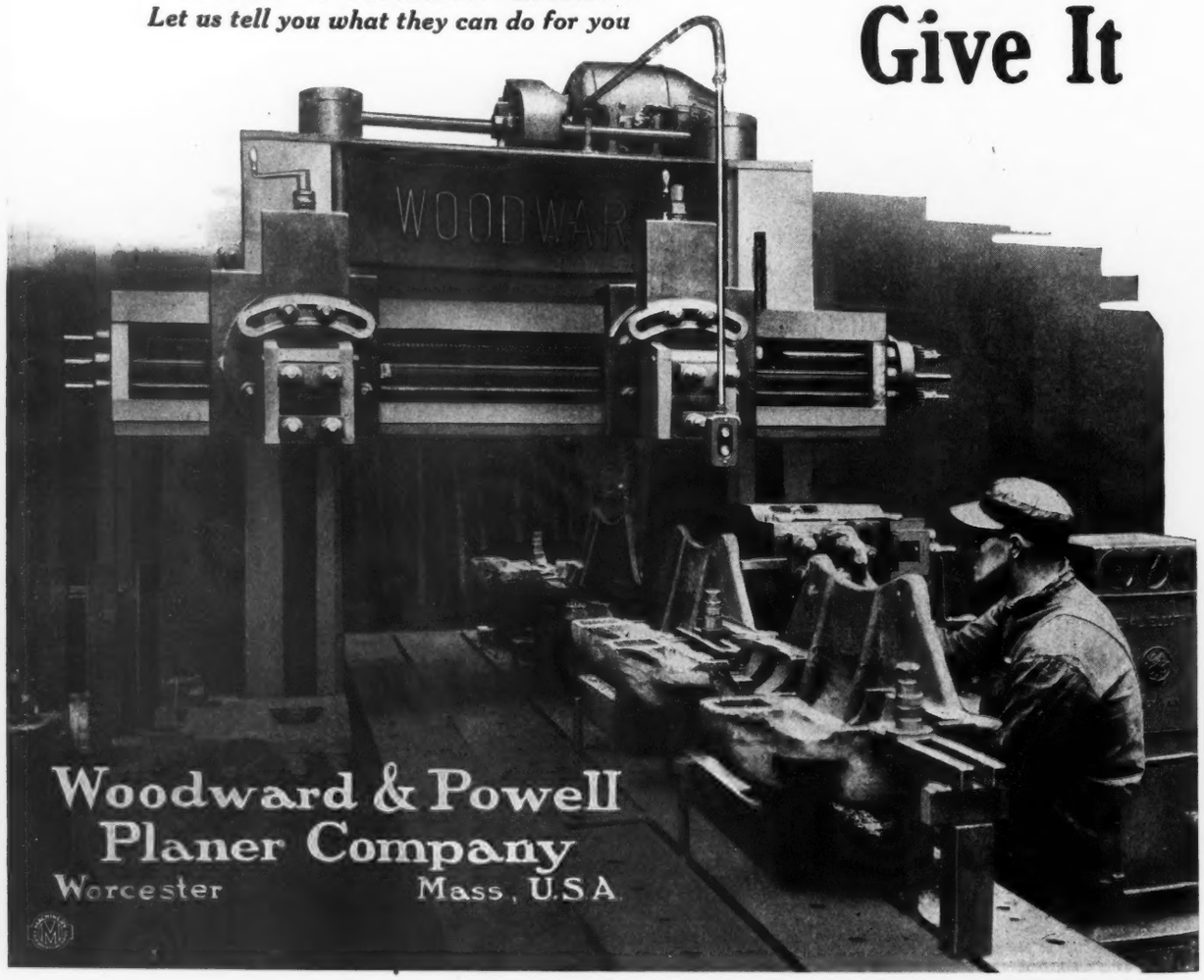
The General Electric shops stand for efficiency in products and equipment. The machines they use are as efficient as the machinery they make.

Logical equipment whether the shop is large or small—Woodward & Powell Planers contribute to the accurate, economical production of many standard tools and machines.

# Woodward & Powell Planers Give It

***Efficient—Convenient—Modern***

***Let us tell you what they can do for you***



# The next thing to Watching a Machine in Action is to See it Photographed in Action—

And that is the first step in the preparation of one of MACHINERY'S Field Advertising Service Advertisements. Study the first half-dozen Field Service pages you come across in this number of MACHINERY and you'll understand the value of advertising of this character.

It takes you right into the shop, shows the machines you are interested in, shows what they are doing and gives the data.

MACHINERY'S Field Service Advertisements are prepared by MACHINERY'S staff for MACHINERY'S advertisers. Their sole object is to make advertising in MACHINERY pay the greatest possible return on the investment.

MACHINERY — NEW YORK

*SET, CAP and SAFETY SET SCREWS*

# mac-it

***Square-head, headless, hollow tool-post***

DON'T put the time of high-priced machinists and expensive machines at the mercy of inferior set-screws. **ONE** break-down and tie-up on **ONE** machine **ONCE** a year costs you far more than to standardize on Mac-its throughout for years to come. We dare you to twist a head off.

Send for sample screw and test block.

**THE STRONG, CARLISLE & HAMMOND CO.**
**Cleveland, Ohio**
**U. S. A.**

***Branches:***
Philadelphia
Pittsburgh
NewYork
Detroit
Chicago
Boston

***Mac-it Endurance—***
***your best insurance***

# Porter-Cable Lathes

*"Meet the Broad Need—For Precision and Speed"*

THE photograph shows part of a steadily growing battery of Porter-Cable Lathes machining Boehm Die Head Chasers in the Erie (Pa.) plant of the Rickert-Shafer Company.

These machines have been especially arranged by this company to perform in the best and quickest way the particular operations allotted to them.

The result has been a 30 per cent increase over former production figures.

The bed of the Porter-Cable Lathe is short, heavy and rigid; the carriage has 25 per cent greater bearing surface than any lathe of like capacity. Feed is positive—operation smooth and fast.

## 30% Production Increase is the Reason for this Steadily Growing Battery

***Porter-Cable Lathes have many other distinct operating advantages well worth investigating. Other speed and accuracy records will also interest you. Send today for complete information.***

## THE PORTER-CABLE MACHINE COMPANY

**SYRACUSE NEW YORK, U.S.A.**

AGENTS: Carpenter & Woodward, Inc., New York City; Colcord Wright Machinery & Supply Co., St. Louis, E. L. Essley Machinery Co., Chicago and Milwaukee; Pacific Tool & Supply Co., San Francisco and Los Angeles; Seifreat-Woodruff Co., Cincinnati and Dayton; W. E. Shipley Machinery Co., Philadelphia; Chas. A. Strelinger Co., Detroit; Strong, Carlisle & Hammond Co., Cleveland; Syracuse Supply Co., Syracuse, Buffalo and Rochester; Vonnegut Machinery Co., Indianapolis. EXPORT REPRESENTATIVE: Benjamin Whittaker, Inc., 21 State St., New York City.

JOHN BATH & COMPANY Inc.

# Bath

## Inventor-Mechanic

# His Book

"The biggest thing John Bath has ever done." That is what one of his friends said about the organization of John Bath & Co., Inc., Worcester, Mass., and that is high praise—for the machine tool industry is indebted to John Bath for many things that are distinctly worth while.

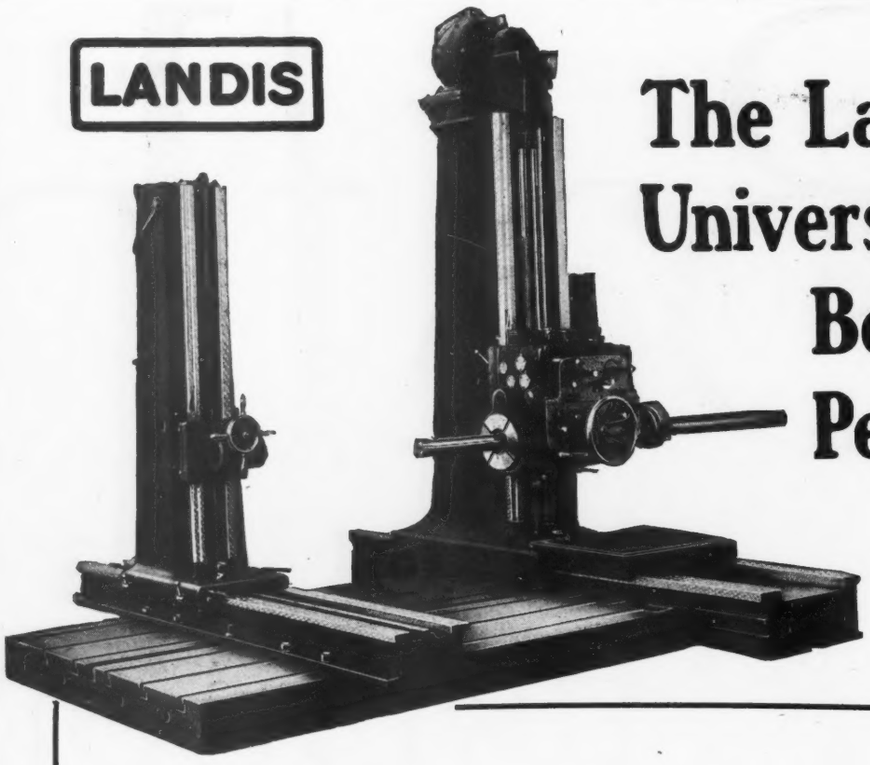
Mr. Bath's entire efforts are devoted to this new company. His reputation as a mechanic is behind every piece of work this organization turns out.

Ours is a contract shop of the highest order for the design and manufacture of Master Gauges, Precision Tools, Special Machinery, etc. We'd like to tell you about our work, our equipment, our facilities and our personnel; also to send you a copy of the book.

You may or may not have immediate use for us; but let's get acquainted anyway. Write us. Ask your questions. Come in and look us over. And send for the book, now, before you forget it.

## WORCESTER MASS., U.S.A.

LANDIS



# The Landis Universal Table Betters Perfection

Not only is the LANDIS Boring, Milling and Drilling Machine a powerful tool, but it is highly adaptable to countless operations by reason of its versatile accessories.

The first glance at a LANDIS gives the impression of inherent power. Its design, its materials and its finish—all show perfection in machine tool construction as a whole. But pick out its component parts, and you will say that *perfection* inadequately describes them.

The Universal Tilting and Rotary Table was designed to allow the boring machine to cover the range it is capable of. With a single set up of the work on this table, five sides, or any angle of the work can be finish-bored, milled, drilled, tapped, etc. On the heavy castings which the LANDIS accurately handles, set-up time is no small item of expense. You can eliminate this item by use of the

## Universal Table

***The LANDIS Boring Machine Catalog gives details of ALL the features of this most modern machine tool. Send in your name for our mailing list.***

## LANDIS TOOL CO.

**WAYNESBORO, PA.**

New York Office: 50 CHURCH STREET

*Agents:* Dewstoe Machine Co., Birmingham, Ala.; Harron, Rickard & McCone, San Francisco and Los Angeles

# Individuality

A GREAT MAN wrote this: "I'm called away by particular business, but I leave my character behind me." And nobody had to guess whose character it was. Even if the familiar Red Cut label should disappear there would be no doubt as to the character of the steel that remained. More than ever would the quality shine forth in the results when it was worked. Adherence to the highest standard with an unvarying uniformity has placed a well merited reputation all its own on

## "Red Cut Superior"

THE NATIONALLY KNOWN - - FIRST QUALITY

## HIGH SPEED STEEL

THE BEST FOR ALL MACHINE WORK

## VANADIUM-ALLOYS STEEL CO.

**General Sales Offices - - - Pittsburgh, Pa.**
**Works - - Latrobe, Pa.**

BRANCHES

BUFFALO
BOSTON
CLEVELAND
CHICAGO
CINCINNATI
DETROIT
TORONTO
NEW YORK
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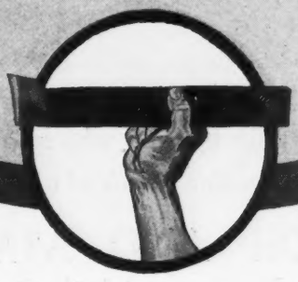
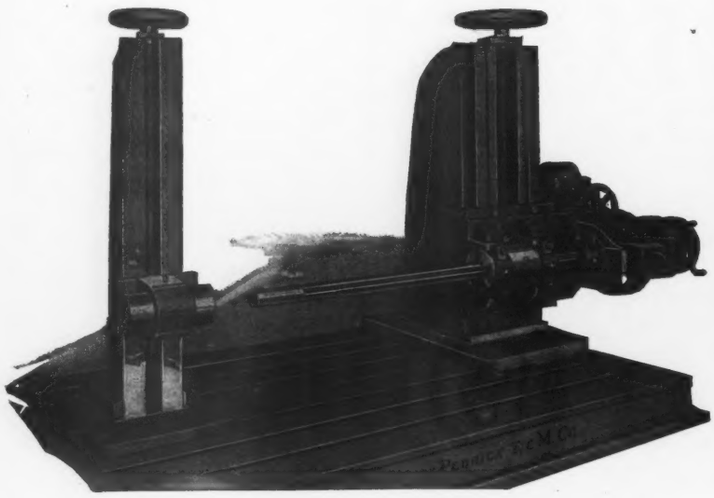
PITTSBURGH



RED-CUT SUPERIOR HIGH SPEED STEEL

# FLAGGED!



**Got the signal, eh!**

This introduces the master mechanic in a N. Y. plant.

"Funny thing," says he, "how we got this Pedrick.

"Boss gets an appropriation for $10,000 to buy a boring machine with all kinds of dingusses on it. Sees the

## Pedrick Column Boring Machine

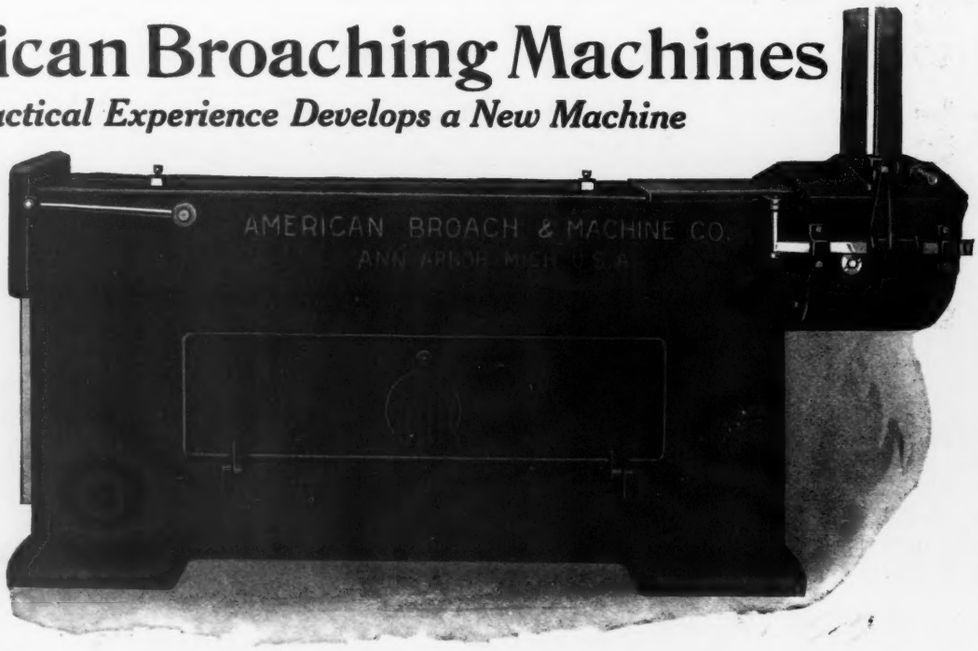
on the job Monday—passes through Philly Tuesday and orders one. We got delivery yesterday, it's done about fourteen jobs already, and the most of the ten thousand is still in the safe. He's tickled, and say —it's a wonder too—bores *any* size hole. And accurate—why they made a new word for it—'accurize.' Means 'to transmit accuracy.' Funny thing, all right."

**Pedrick Tool & Machine Co.**
**3639 North Lawrence Street**
**PHILADELPHIA PA., U. S. A.**

# American Broaching Machines

***Practical Experience Develops a New Machine***

Deep heavy bed and massive base. Solid steel head with large hardened and ground steel shoes. Buttress type screw. Direct driven oil pump. Ball handle control. Internal gear, single belt drive. Nut and thrust bearing in separate compartment and not subject to injury from gear wearings.

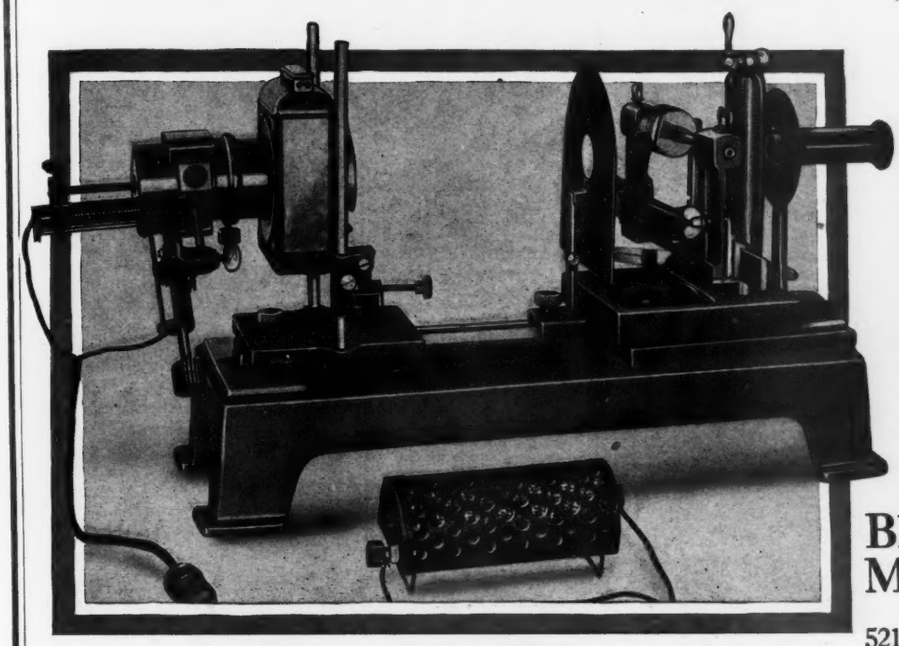



**Designed and built by men who know—it's worth investigating.**

***Broaching tools of all types and sizes***

**AMERICAN BROACH AND MACHINE COMPANY**
**ANN ARBOR** **F. J. LAPOINTE, President and Authority on Broaching** **MICHIGAN**

# The Blair Projectograph



The principle is simple. Thread gage to be measured is mounted on centers, profile of thread lined up with lens in front and powerful light in rear. Exact profile is projected, 50 or 100 times magnified, on screen. Shadow is compared with exact master drawing. Defects are easily detected. Standard with American and Allied Governments. May be used also for measuring cutter and templet contours, etc. Will save time and money. Prompt shipments

*Ask for "Four Aces"*

**Blair Tool and Machine Works**
INCORPORATED
521 Greenwich St., NewYork

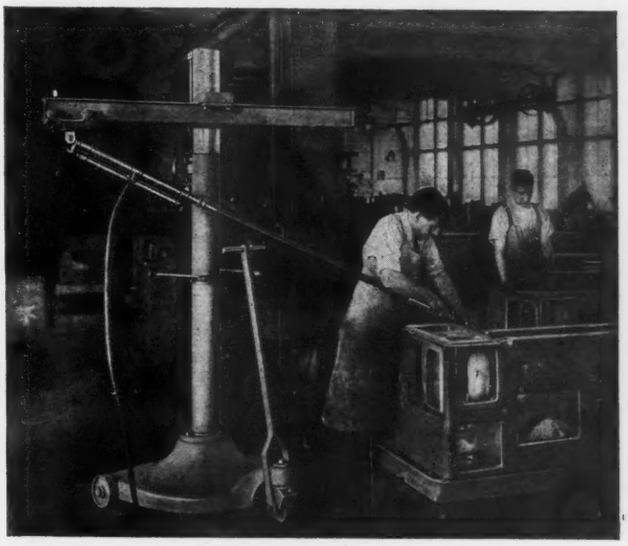
## THREAD GAGE CHECKING SIMPLIFIED

# SCRAPING

## *How do You do it?*

Do your men wear themselves out scraping by hand and get but little work done by the end of the day; or have you installed the

## ANDERSON PNEUMATIC SCRAPER

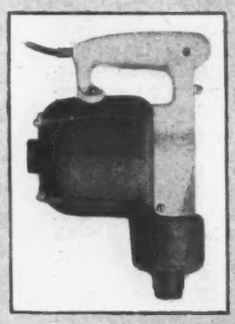


It turns out three times the work of hand scraping, yet the "human touch" is never lost. "Do it with air"—the modern, efficient way. Your men will thank you, and you'll pull down costs—make more profit on your product. Write for full information—*now!*

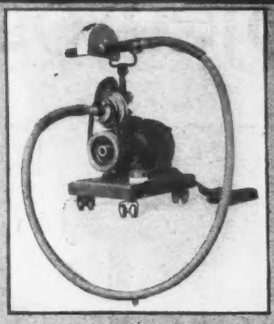
The

**ANDERSON BROS. MANUFACTURING COMPANY**
117 MORGAN STREET
ROCKFORD ILLINOIS, U. S. A.

PORTABLE ELEC

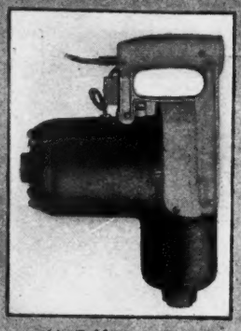


U-2 Hammers

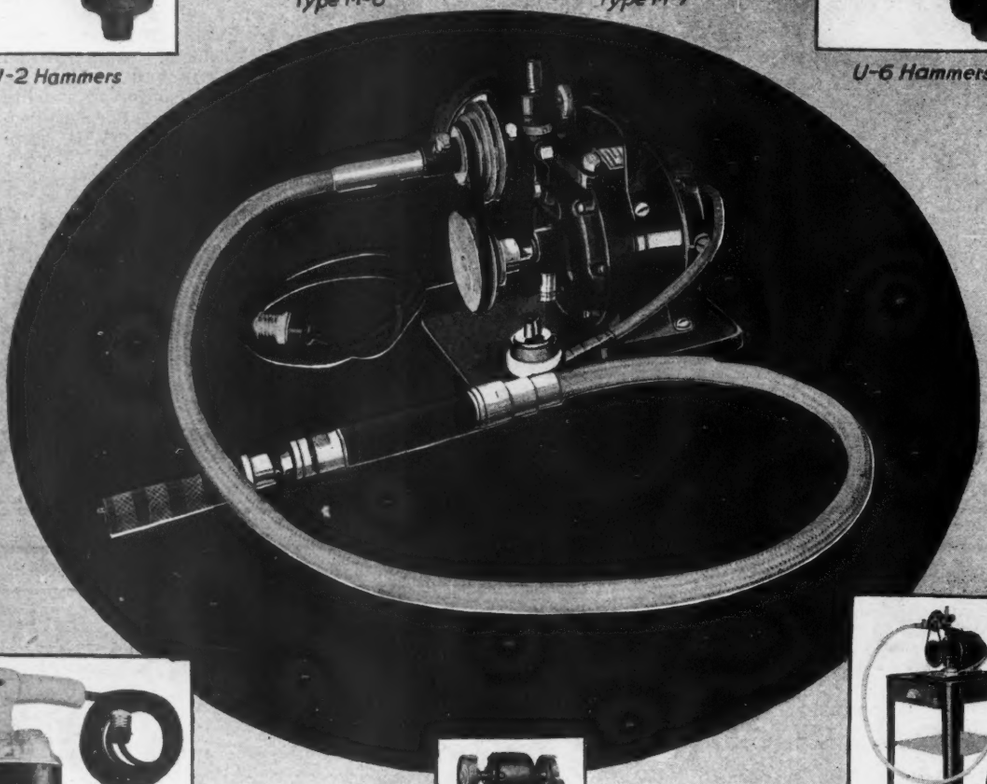


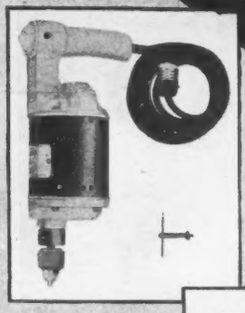
Type M-6

Type M-7



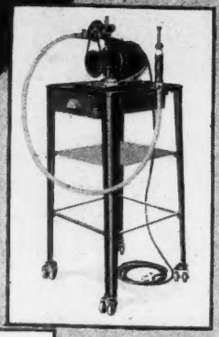
U-6 Hammers



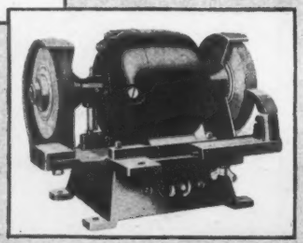


Type U-B

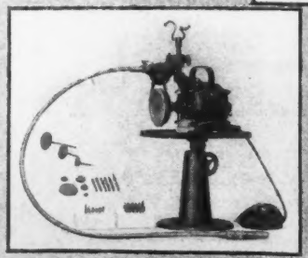
Floor Type Grinder



Type MS-4



Bench Grinder



Die-Sinking Outfit

R. G. HASKINS

# TRIC MACHINERY

THERE'S a Portable Electric Machine in the Haskins Line to meet every requirement of the machine shop whether large or small. For light or heavy grinding, internal or external grinding operations for drilling jobs ranging from 3/16" to 1¼", there's a Haskins tool that will handle the work quickly and economically. There are so many jobs in every shop on which a Haskins Portable Electric Tool may be utilized at a saving in time, labor and money, that to continue to "get along" without Haskins Equipment is to curtail profits. Haskins Tools have, through performance and utility, gained a reputation that anyone purchasing Portable Electric equipment cannot fail to take cognizance of. They are the best that money can buy.

Write for catalog on machines you are interested in.

**R. G. HASKINS CO.**
**CHICAGO**

R. Morley, 426 Broome St., New York.
C. G. Gilbert, No. 2 Goebel Bldg., Detroit, Mich.
C. W. Schuchardt, St. Louis, Mo.
Fred J. Neubauer, 362 Colonial Arcade, Cleveland.

SAVES
Time
Labor
Money

CO. 547 W. Washington Blvd.
CHICAGO, ILL.

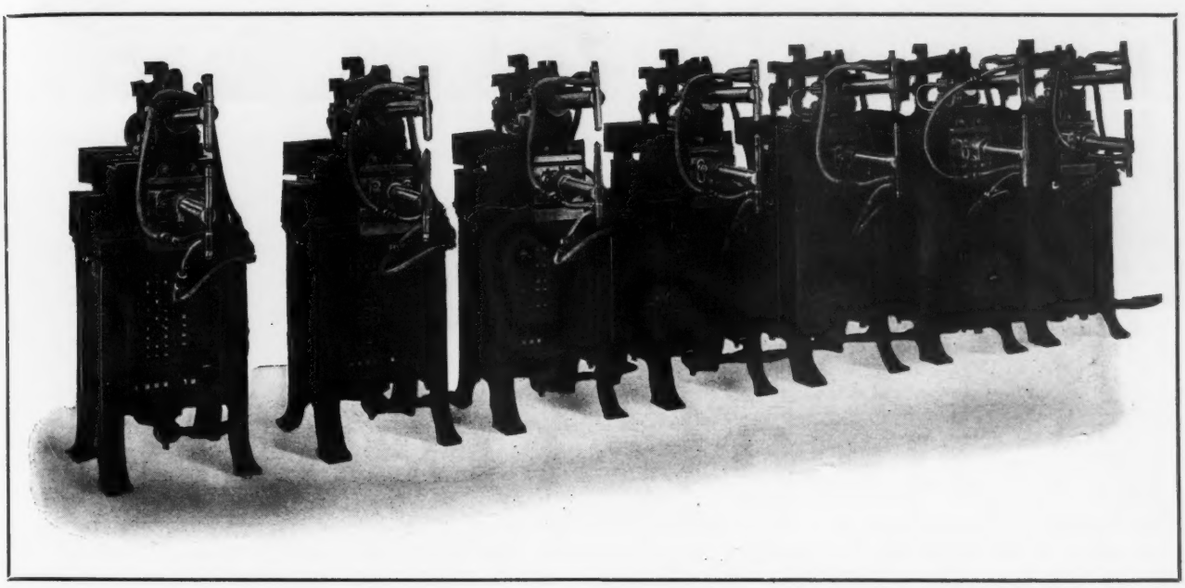
# Federal

## Welding Machines Are of Great Value in Stove Manufacturing

Federal Welds Form the Joints That Last

# THE FEDERAL MACHINE

| | | | |
|---|---|---|---|
| OFFICES AT | Warren | Ohio | Dana Avenue |
| | Cleveland | Ohio | 401-402 Garfield Bank Bldg. |
| | Chicago | Ill. | 15 S. Clinton Street |
| | Detroit | Mich. | 1516 Ford Building |
| | Philadelphia | Pa. | 613 Lincoln Building |
| | New York City | N. Y. | 110 W. 40th Street |



# One Thousand Parts and Accessories Are Assembled by Federal Welding

With a range of products so great that there are over 1000 different pieces to be assembled, the big stove manufacturer, in whose plant our photograph was taken, fully appreciates the value of his Federal Welder Equipment.

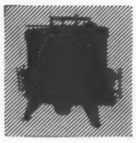
Production is greater than when the parts were riveted; finish is better; wearing qualities have been increased and manufacturing costs lowered by Federal Welding. The photograph shows the spot welding of cleats on oilstove chimneys. Production depends largely on the dexterity of the operator, and in this particular case reaches 300 chimneys, 1800 welds per hour. Permanent joints which are not affected by the rapid cooling and heating to which these parts are subjected and which caused shrinkage and eventual deterioration when rivets were used.

For details of Federal Spot and Butt Welding Machines write us for Bulletins 31, 32, 33. For details concerning your work ask for special information. Federal Welders are sold outright to the users—we have no royalty proposition to offer.

## & WELDER COMPANY

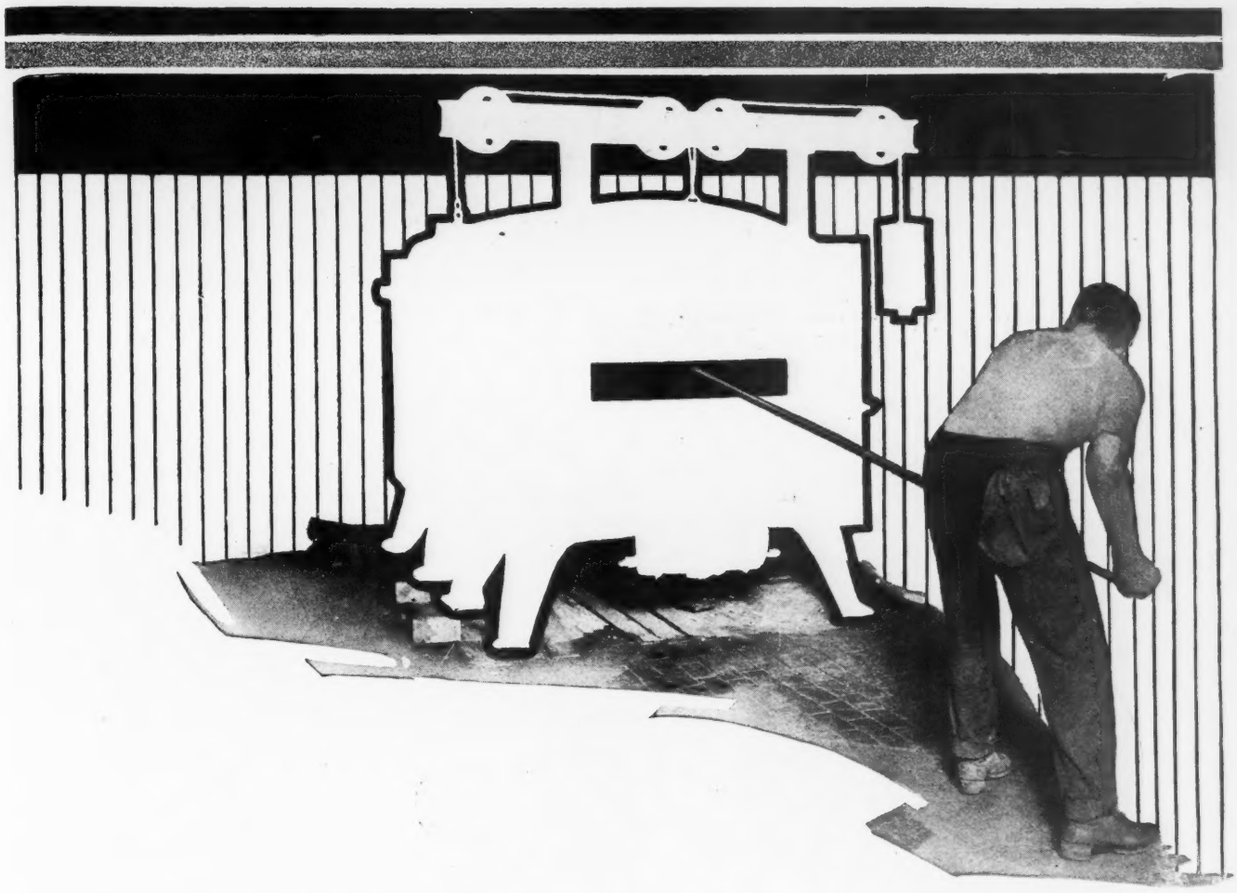
| | | |
|---|---|---|
| **Boston** | **Mass.** | **19 Huntington Street** |
| **New York City** | **N. Y.** | **30 E. 42nd Street** |
| **Niagara Falls** | **N. Y.** | **311 Falls Street** |
| **Montreal** | **Canada** | **501 Power Building** |
| **Minneapolis** | **Minn.** | **Builders Exchange Building** |
| **Indianapolis** | **Ind.** | **Board of Trade Building** |

# When it's heat-treating get in touch with



# Strong, Carlisle & Hammond

at once



WHEN there's a need to be filled in your heat-treating department steer clear of all experiments, "stop-gap" equipment and makeshifts.

Go to the manufacturer whose furnaces are designed by men who are both trained engineers and *practical heat-treating experts.* Then buy the furnace they have designed *for your particular specialized need.*

Strong Carlisle & Hammond
INDUSTRIAL FURNACES

**For Oil, Natural Gas or Manufactured Gas**
*Catalog on request*

A heat-treating furnace receives work in which there is already a high investment in labor and machine cost. Don't gamble with that investment.

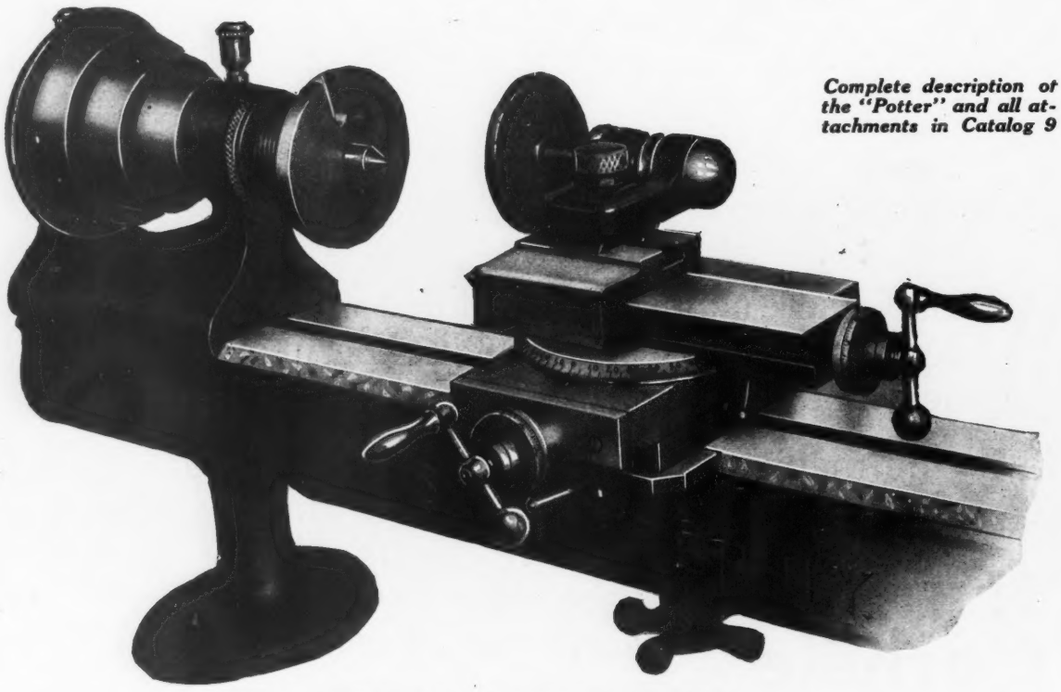
With Strong, Carlisle & Hammond equipment you play absolutely safe—let us prove this.

THE STRONG, CARLISLE & HAMMOND CO., CLEVELAND
BRANCHES:—BOSTON NEW YORK PHILADELPHIA PITTSBURGH DETROIT CHICAGO

# The Potter 7" Precision Lathe

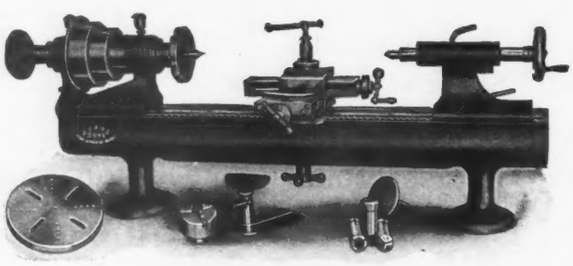
## A Toolroom in Itself

Precision, rigidity and versatility have been specially developed in this well constructed bench lathe. The bed is wide, with broad, carefully fitted bearing surfaces and substantial head and tailstock. Compound rest is provided with screws of tool steel running in bronze nuts; index slide is graduated to 60° on either side; and friction dials are instantly adjustable to .001". The machine may be further equipped with Two or Three Speed Grinding Countershafts, Double Cross Slide, Lever Tail Stock, Large or Small Turret, Improved Lever Chuck Closer and Attachments for Universal or Internal Grinding, Thread Cutting and Milling, which make it practically universal—a toolroom in itself.



*Complete description of the "Potter" and all attachments in Catalog 9*

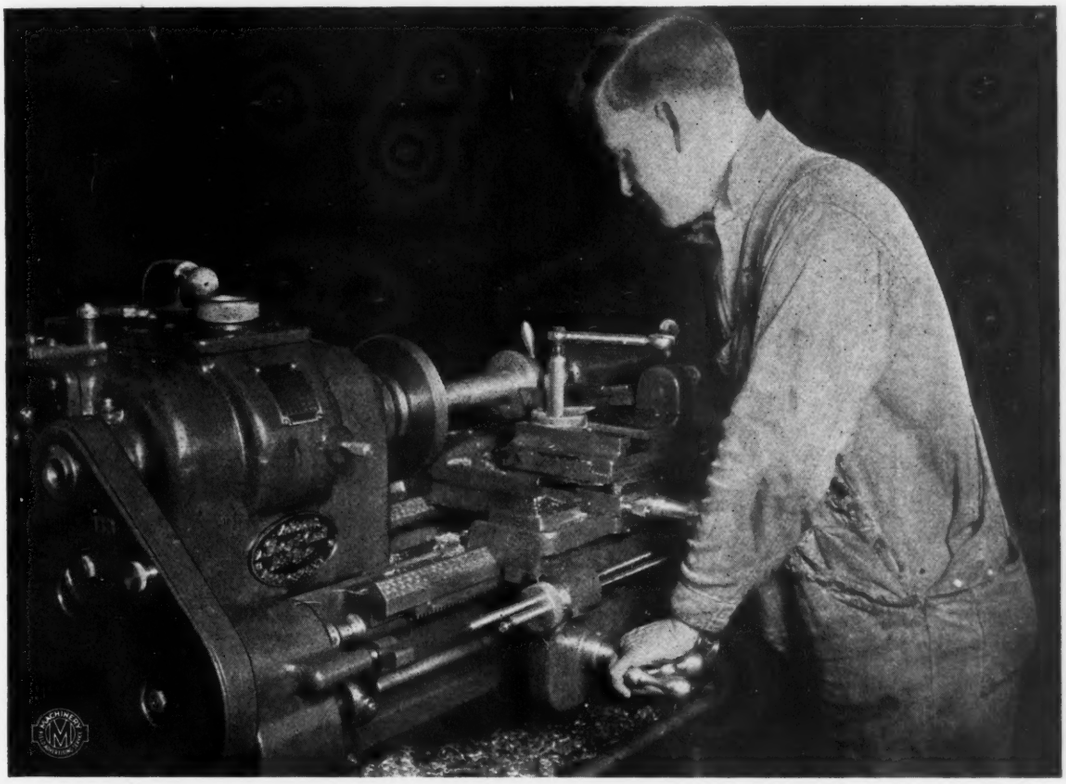
UNIVERSAL GRINDING ATTACHMENT



The Universal Grinding Attachment fastens directly to the top slide of the compound rest and is fully self-contained. It can be run as high as 20,000 or 25,000 R.P.M., and takes wheels from ¼" to 3" diameter. Up and down adjustment of the spindle is obtained by a positive rocker mechanism—an exclusive "Potter" feature.

## S. A. POTTER TOOL & MACHINE WORKS

77 E. 130th Street NEW YORK CITY



# ADAMS SHORT-CUT LATHE

## A MOVE IN THE RIGHT DIRECTION

No production records have yet been set by this Adams Short-Cut Lathe, nor have any precedents been established. It has in fact, just been installed by the Brown-Lipe-Chapin Co., Syracuse, and is on its first job. Needless to say, however, there was a reason back of the purchase. This company had seen what the Adams Short-Cut Lathe had done elsewhere; it knew the name was no misnomer. It was well aware that a *real short-cut* would be made in floor to floor time—and so—well here's the machine in place.

And the job! Turning the *shanks* of nickel steel pinions for 4″ in length to a diameter of 1.590″. A cut .020″ deep is taken at high speed. Are you equipped?

## O. R. ADAMS MFG. COMPANY, Inc.

**NORTON STREET** **ROCHESTER, N. Y.**

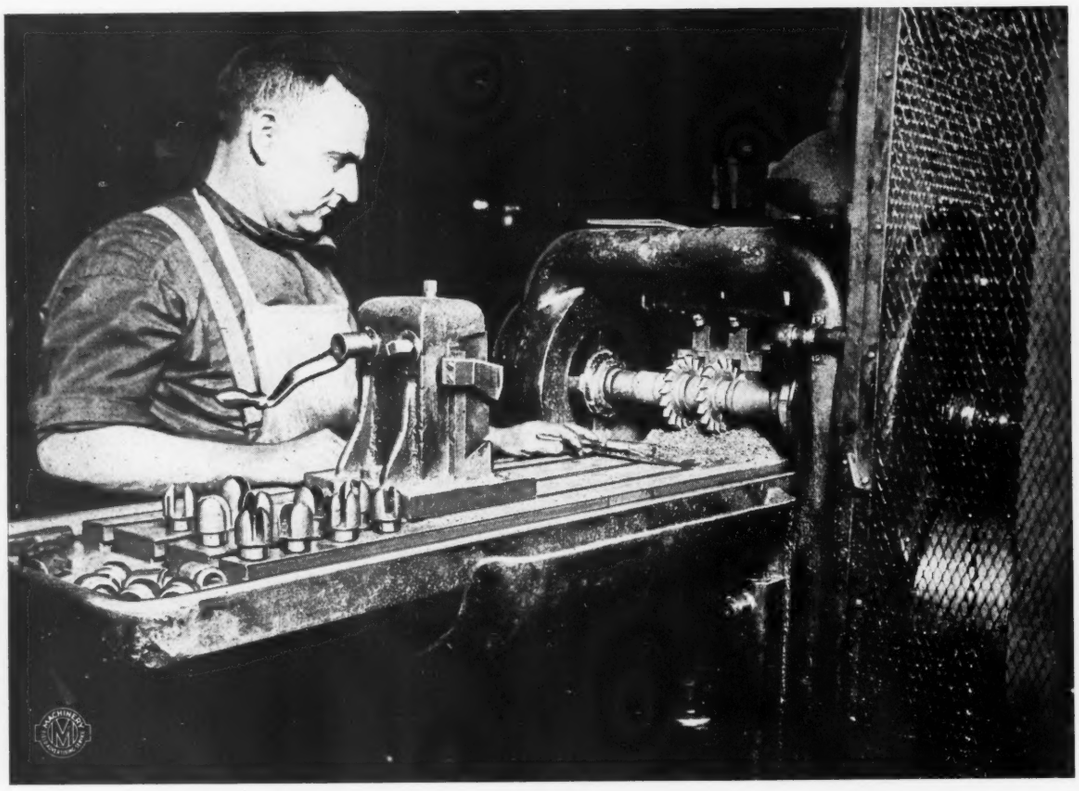
**AGENTS:**

Federal Machinery Sales Co., Chicago, Ill.
Ogden R. Adams, Syracuse, Rochester, Buffalo.
Hill, Clarke & Co., Boston, Mass.
Swind Machinery Co., Philadelphia, Pa.

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST. NEW YORK, U.S.A.
PARIS TURIN ZURICH BARCELONA

**AGENTS:**

W. M. Pattison Supply Co., Cleveland, O.
Riverside Machinery Depot, Detroit, Mich.
National Supply Co., Toledo, O.
Herberts Machinery & Supply Co., Los Angeles, Cal.



# Quadrupling Production with the BRIGGS MILLER

This picture shows one of the many short cuts in production which characterize Robbins & Myers manufacturing methods.

The Briggs Miller is set up for the slotting operation on cold rolled steel electric fan base knuckles. The slot is 1 7/16" deep by 3/8" wide. The straddle-mounted milling cutters slot four pieces simultaneously, the arc of the cut having its center on the axis of the knuckle.

Two fixtures are used, one being re-loaded while the other is in on the machine. Production on this job is 80 per hour. A simple milling job, considered by the piece, becomes *some* cut when the strains of the quadruple set-up are considered.

The solid arch insures a chatterless job in spite of forced production. Send for further details and more Briggs Miller production figures.

## GOOLEY & EDLUND, Inc., Cortland, N. Y.

DOMESTIC AGENTS: Vandyck-Churchill Co., New York and New Haven; Monarch Machinery Co., Philadelphia, Pa.; Lynd-Farquhar Co., Boston, Mass.; Syracuse Supply Co., Syracuse, Rochester and Buffalo, N. Y.; Brown & Zortman Machinery Co., Pittsburgh, Pa.; English & Miller Machinery Co., Detroit, Mich.; Federal Machinery Sales Co., Chicago, Ill.; Vonnegut Machinery Co., Indianapolis, Ind.; Cleveland Tool & Supply Co., Cleveland, O.; Blackman-Hill-McKee Mchy. Co., St. Louis, Mo. FOREIGN AGENTS: Burton, Griffiths & Co., Ltd., London, Manchester and Glasgow; Andrews & George, Tokyo.

OVER-SEAS REPRESENTATIVE

ALMACOA ALLIED MACHINERY COMPANY OF AMERICA 51 CHAMBERS ST. NEW YORK, U.S.A. ALMACOA

PARIS TURIN ZURICH BARCELONA PETROGRAD

# NOTICE

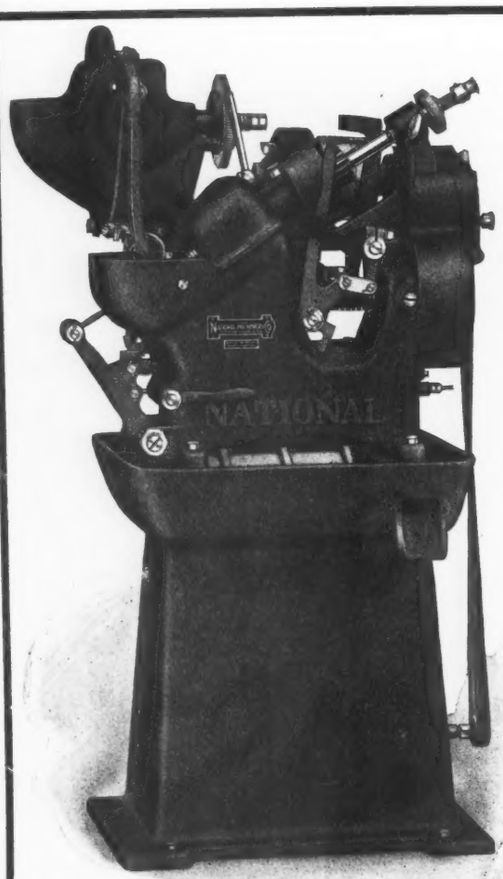
The entire output of our present facilities for a year in advance having been taken by the

## Principal Automobile and Locomotive Manufacturers of the Country

has made it necessary to triple the capacity of our present plant. This addition will be completed by September 1st, 1919, thus preventing interference with deliveries on present or future orders.

THE DEFIANCE MACHINE WORKS
DEFIANCE, OHIO, U. S. A.

Established 1850




*Makes Your Tapping Department Pay Bigger Dividends*

If you tap nuts of good quality, ⅛ to ½" in size—you ought to know about the

# National Automatic (Bent Tap) Nut Tapper

It will give you bigger outputs, longer tap life and less tap breakage. Requires minimum attention. We have some interesting literature and data on this new tapper.

Tell us the size and quantity of nuts you tap and *let us furnish details.*

## The National Machinery Co.

TIFFIN, OHIO, U. S. A.

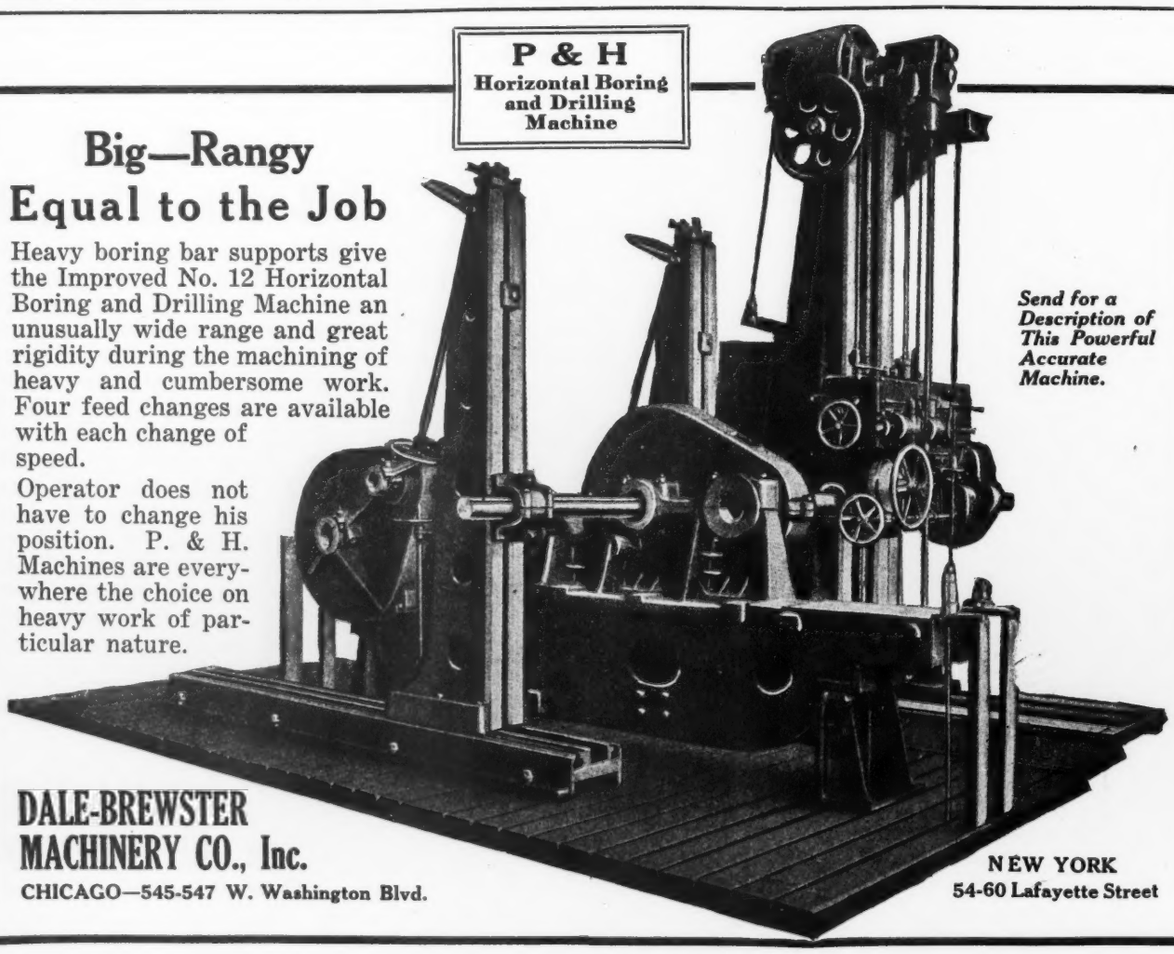
*Originators of Modern Bolt, Nut and Forging Machinery*

**P & H**
**Horizontal Boring and Drilling Machine**

## Big—Rangy Equal to the Job

Heavy boring bar supports give the Improved No. 12 Horizontal Boring and Drilling Machine an unusually wide range and great rigidity during the machining of heavy and cumbersome work. Four feed changes are available with each change of speed.

Operator does not have to change his position. P. & H. Machines are everywhere the choice on heavy work of particular nature.



*Send for a Description of This Powerful Accurate Machine.*

**DALE-BREWSTER MACHINERY CO., Inc.**

CHICAGO—545-547 W. Washington Blvd.

NEW YORK
54-60 Lafayette Street

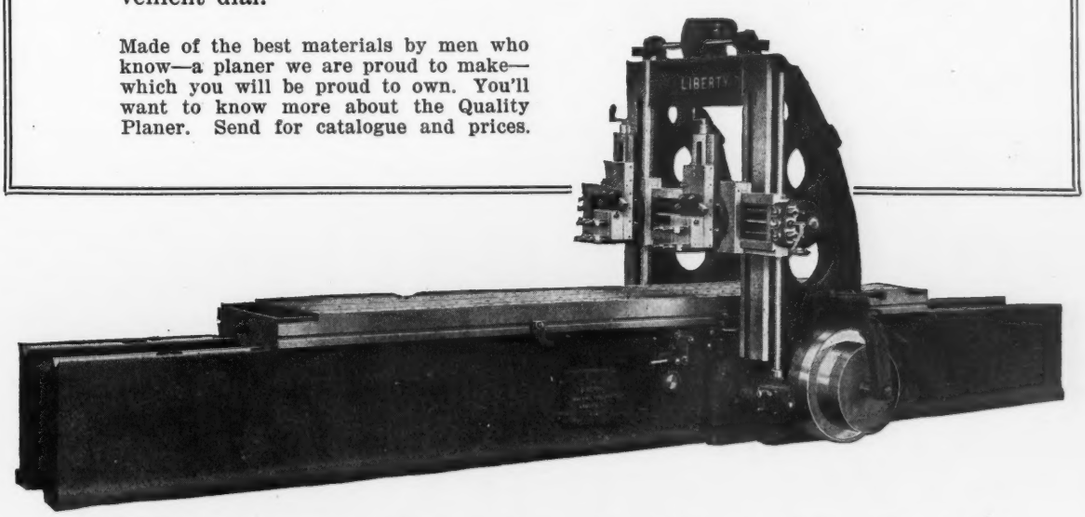
LIBERTY MACHINE TOOLS

# The Quality Planer

The Quality Planer is correctly named—it's a real "quality" tool. In construction it has followed precedent only where precedent was proved good—it has many unique features.

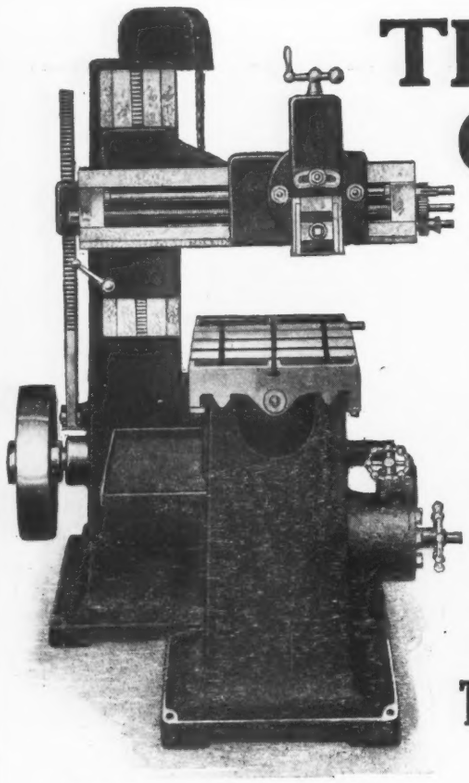
The bed is deep and exceptionally rigid; the planer upright extends to the floor. Driving gears—mounted on pinion hubs—are enclosed in bed. An outstanding feature is the patented feed, permitting changes at any time without stopping the machine. All operating handles are located to permit of easy control, the amount of feed being shown on a convenient dial.

Made of the best materials by men who know—a planer we are proud to make—which you will be proud to own. You'll want to know more about the Quality Planer. Send for catalogue and prices.




THE LIBERTY MACHINE TOOL CO.

HAMILTON, OHIO, U. S. A.



# THE COULTER
## Open Side Planer

There is a lot of planing required on dies, jigs, etc., and often no machine in the average toolroom to handle this work to good advantage. The Coulter Open Side Planer has been developed for just this class of service. The open side permits large, irregular shaped pieces to be planed and gives the operator at all times a clear view of his work. Four speeds provide for machining tool steel, machine steel, cast iron and bronze with equal advantage. Adjustments are all within easy reach of the operator. Shaper speed and convenience plus planer accuracy make an ideal combination. Let us tell you *all* about it.

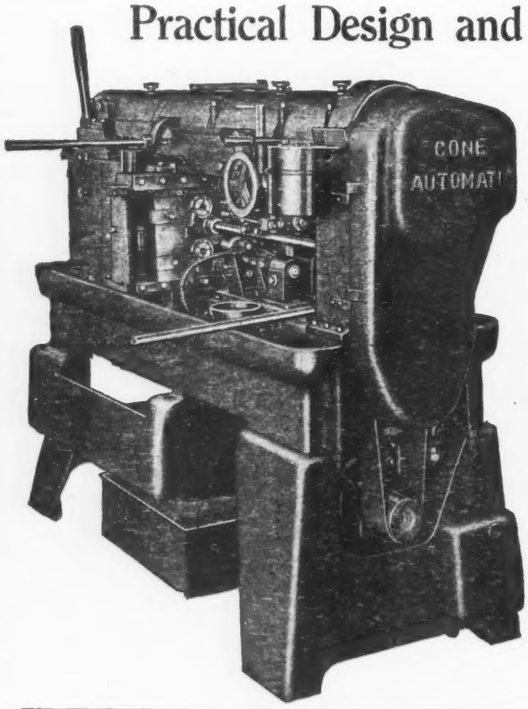
**THE AUTOMATIC MACHINE CO.** Bridgeport, CONN.

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST. NEW YORK, U.S.A.

PARIS TURIN ZURICH BARCELONA

*SKF Ball Bearings Liberally Used Throughout*

Practical Design and Exclusive Features Recommend




# The Cone Four Spindle Automatic

All four spindles work in this machine—three are in forming positions and one is for cutting-off—the latter being the upper front spindle, so the finished work is always in sight. These spindles are all hard and are provided with adjustable bearings. All movements are obtained by flat cams bent to fit cam drums carried on a cam shaft in the upper bed. A single belt drives the whole mechanism and controls are simple, conveniently located and, as far as may be, foolproof.

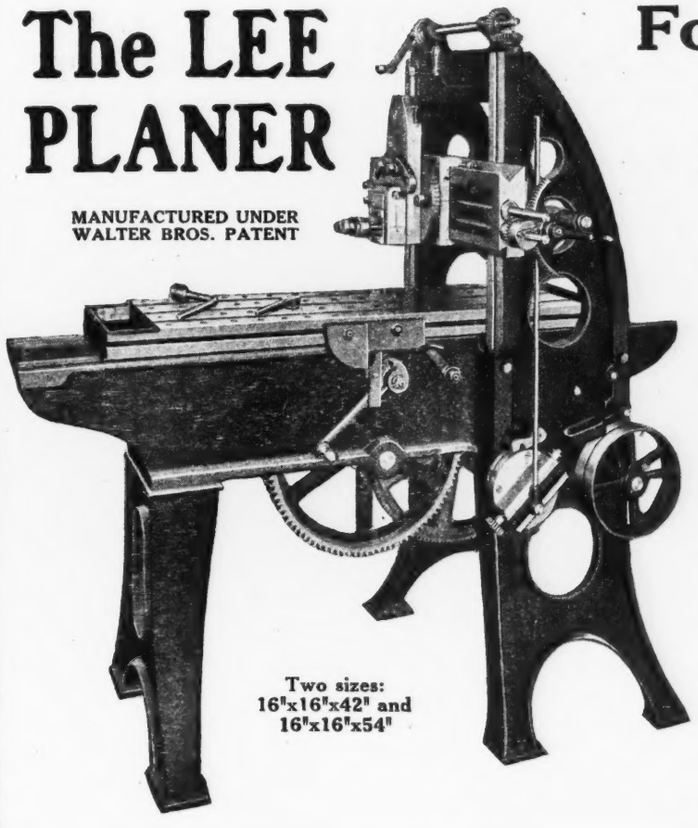
***Complete description furnished on request***

**CONE AUTOMATIC MACHINE CO., Inc.**
WINDSOR VERMONT, U. S. A.

Agent for Michigan Territory: J. C. Austerberry, 65 Shelby Street, Detroit, Mich.

# The LEE PLANER

MANUFACTURED UNDER WALTER BROS. PATENT



Two sizes:
16"x16"x42" and
16"x16"x54"

## For Tool Room or Factory

Are you planing small work on a big planer? Yes! You're losing money—using too much power; not to speak of too much planer.

Think of all the small and medium sized jobs—both in tool room and factory — which a Lee Planer would do at a fraction of the cost. It's easier handled, too; and gives both speed and accuracy.

*Ask for the booklet.*

## THE FRANK H. LEE CO.

**Specialists in Contract Manufacturing**

**DANBURY CONN., U.S.A.**

# The Standard 4" Centering Machine

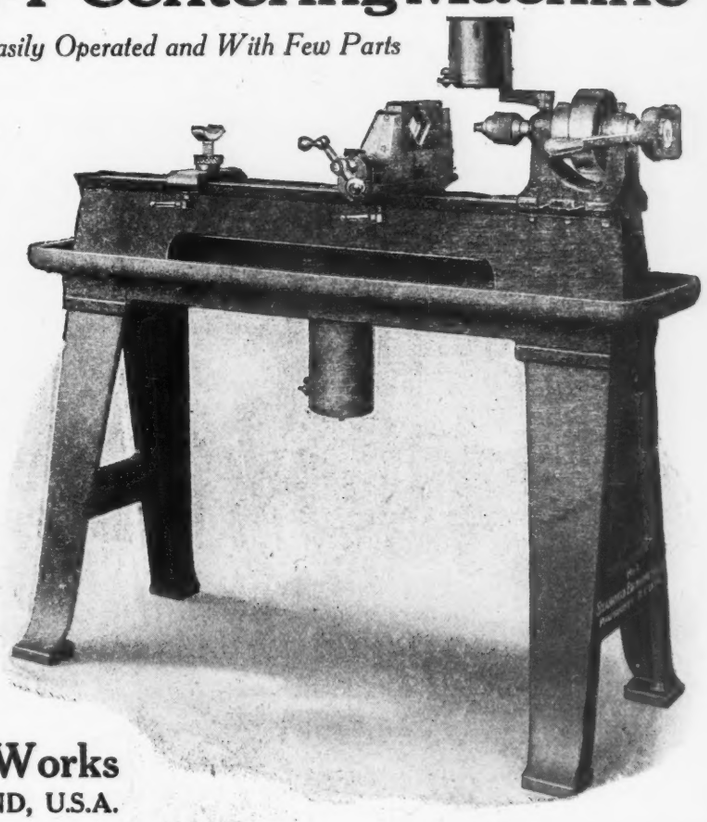
*A Practical Single Spindle Machine Easily Operated and With Few Parts*

Distinctive features make this a convenient, sturdy machine, better than average equipment of its class. Strain on the spindle is eliminated—the drive pulley runs externally on extended bearing bushings and the operating lever is also rigidly supported without resting on the spindle.

The right and left hand screw which operates the vise jaws is protected from the work by a steel guard plate and is adjustable by means of a bronze bearing which can be locked.

These and other features recommend this tool to the up-to-date shop man. It is rapid, accurate and good for a long term of service.

***Also furnished with two spindles. Details of both machines on request.***



## Standard Engineering Works

**PAWTUCKET RHODE ISLAND, U.S.A.**

# TIME STUDIES Prove the Economy of the "Smalley-General"

## A Smalley-General Thread Miller No. 23 Made This Record

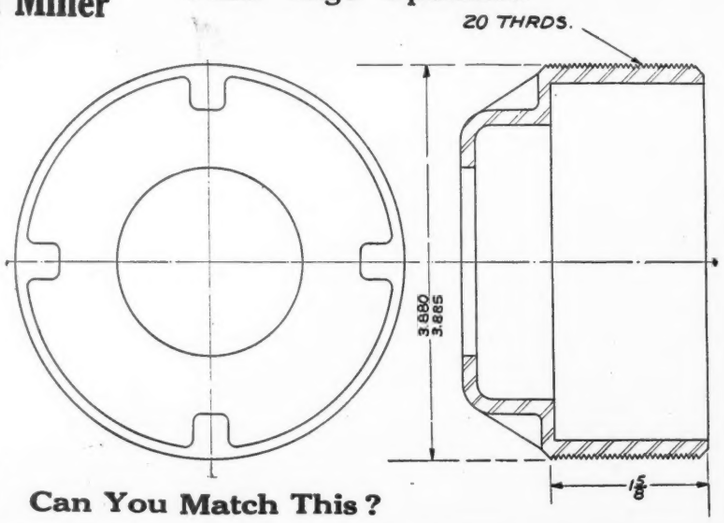
The work is a malleable iron axle cage for an automobile, chucked on an expanding mandrel.

The thread — 3.88″ diameter, 1⅝″ length, 20 pitch, U. S. Form Straight Thread. Milling feed —14″ per minute.

Time study—

| | | |
|---|---|---|
| Chucking, | 7 | seconds |
| Adjusting hob | 10 | " |
| Milling, | 60 | " |
| Chamfering, | 15 | " |
| Removing from chuck, | 8 | " |
| Total, | 1 minute, 40 seconds | |

Axle Cage Operation

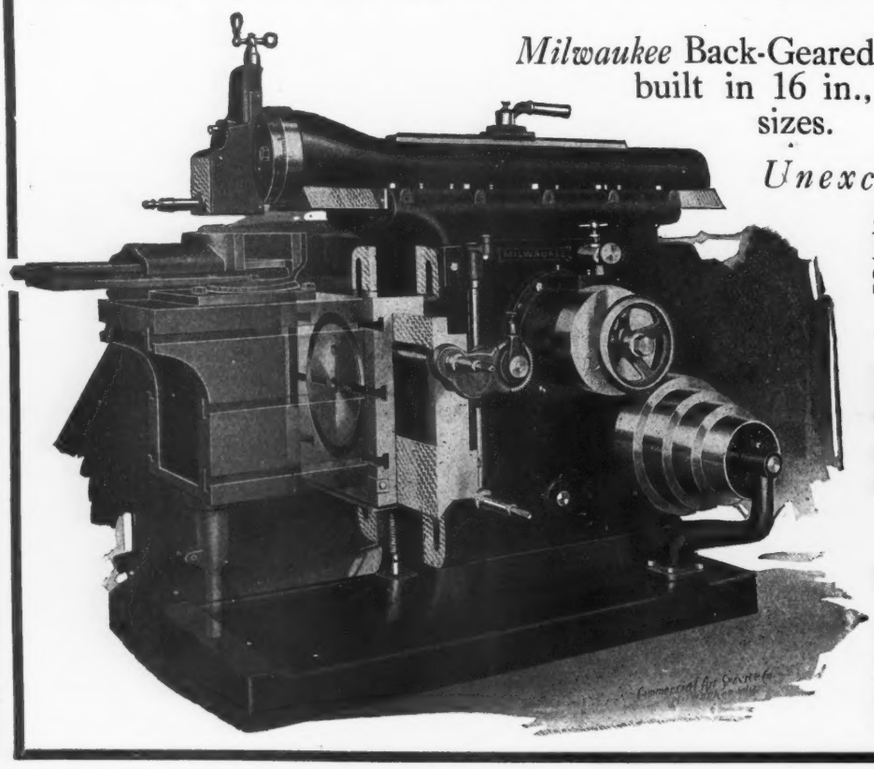



**Can You Match This?**

## SMALLEY-GENERAL CO., Inc., SMALLEY PLACE BAY CITY, MICH.

AGENCIES: Machine Tool Engineering Company, New York; E. L. Essley Machinery Co., Chicago and Milwaukee; Rudel-Belnap Machinery Co., Montreal and Toronto; Thomas I. Cochran, Addison Hotel, Detroit, Mich. The Luster Machinery Co., Philadelphia, Pa.

# Milwaukee Shapers



*Milwaukee* Back-Geared Crank Shapers are built in 16 in., 20 in. and 24 in. sizes.

*Unexcelled* in Rigidity, Accuracy, Power, Production and Simplicity.

## MILWAUKEE SHAPER CO.

**1144-1146-1148 Holton St.**
**518 Prairie Street**

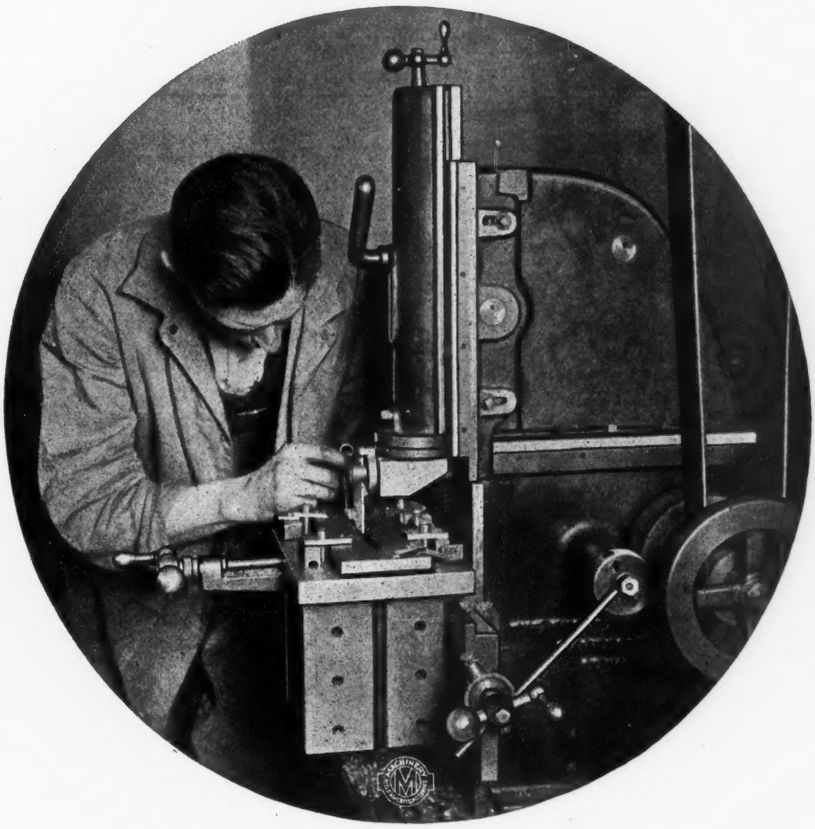
**Milwaukee Wisconsin**

REPRESENTATIVES

E. L. Essley Machinery Co., Chicago and Milwaukee; Cadillac Tool Co., Detroit and Cleveland; Laughlin & Barney, Pittsburgh; Ogden R. Adams, Rochester, N. Y.; Dale-Brewster Machinery Co., New York
FOREIGN: B. L. Bobraff, Russia; Manning, Maxwell & Moore, Belgium.

# RHODES SHAPERS

## "ACCURATE BEYOND ALL EXPECTATIONS"



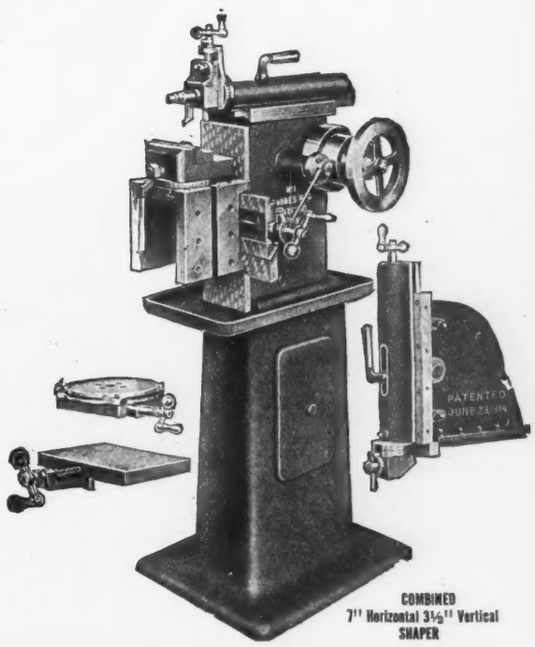
OUR snapshot artist has just returned from a short tour, "combining," as he puts it himself, "business with pleasure." The "business" he explains, is getting to see as many Rhodes Shapers as he can, (and it's *some* business nowadays); the "pleasure," in listening to what folks are saying about this machine.

Remembering that the Thorn Machine Tool Co. at Syracuse, N. Y., had been periodically ordering Rhodes Shapers since September, 1918, he loaded up his film pack and dropped in. "Finest little machine of the kind ever put in a shop," said the man in charge, "It's accurate beyond all expectations."

Rhodes Shapers are great for tools and dies, and handle much small work formerly done on heavy expensive shapers. Note the Vertical Attachment on the machine in the photograph. They work in two planes you know—horizontal and vertical—interchangeable at will.

"Yes! Most everybody wants the Rhodes Shaper" said the man who knows, "just as soon as they find out what it will do. Call again."

**RHODES 7" Horizontal 3½" Vertical SHAPERS**

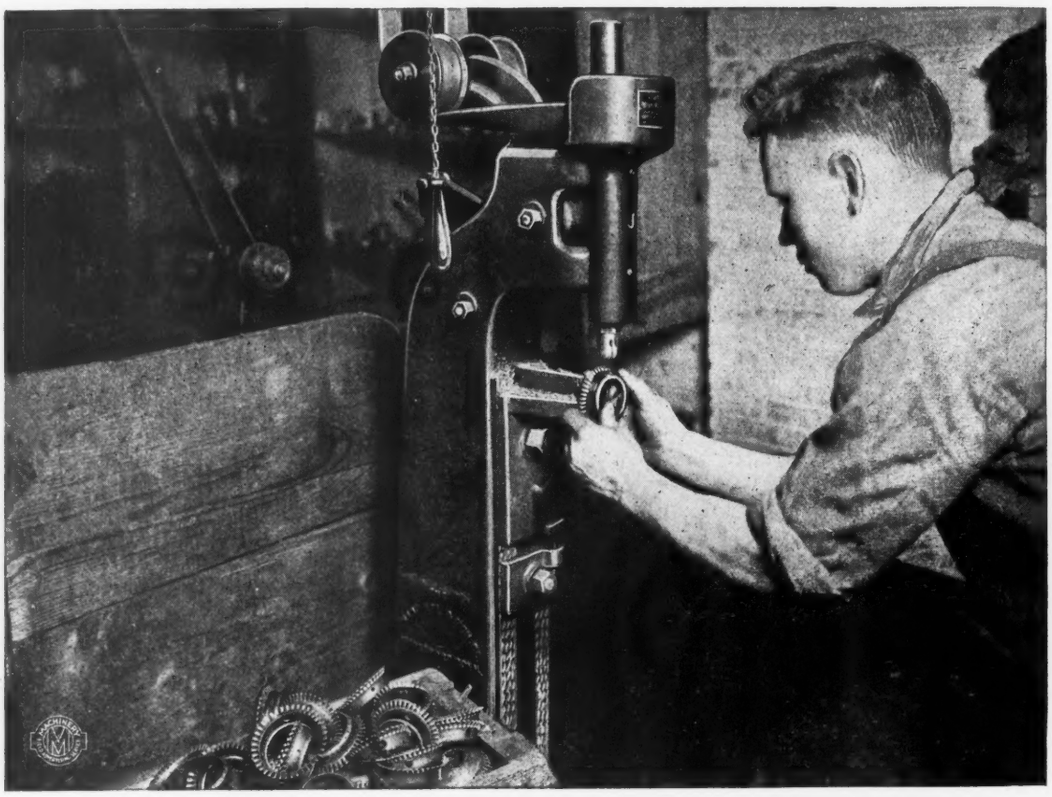


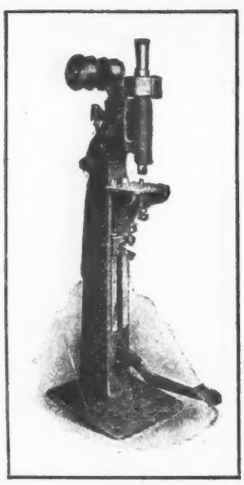

## THE RHODES MFG. COMPANY

### HARTFORD, CONN.

# GRANT RIVETING

## These Steel Rivets "STAY PUT"





RAPID, accurate and foolproof, the Grant Riveter plays an important part in assembling the products of the Climax Motor Devices Co. (Cleveland, O.) The universal flexible magneto drive couplings shown in the photograph are assembled in two operations—each setting two rivets. The first rivets the springs on the hub cap, the second assembles the cap onto the coupling proper. The spring of the rivet limits production on the first operation to 160 rivets per hour; the second operation produces 220 couplings—440 rivets per hour. Well set, excellently finished and *permanent*—the rivets are fitting complements to the well finished parts of the coupling proper.

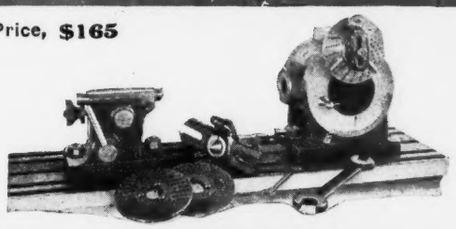
***Grant Riveters set tight and loose rivets in all metals. Durable, economical machines for WORK THAT LASTS. Let us tell you more about them.***

## Grant Manufacturing and Machine Co.

BRIDGEPORT N. W. Station CONNECTICUT

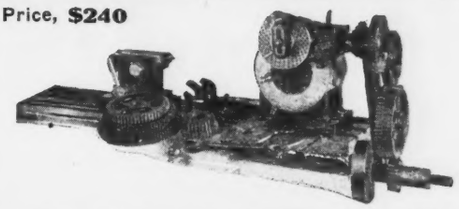
# SIMMONS
## OF ALBANY

Price, **$165**



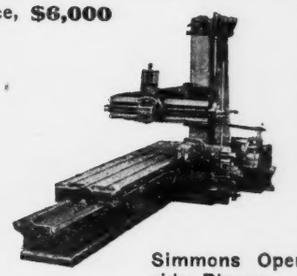
Plain Index Centers
Swing 10" Diam.

Price, **$240**



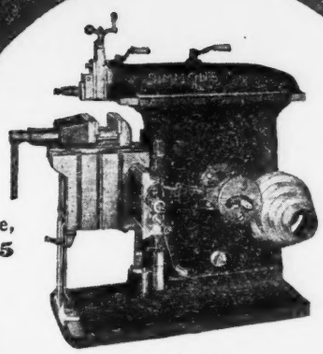
Universal Index Centers with Spiral Cutting Attachments

Price, **$6,000**



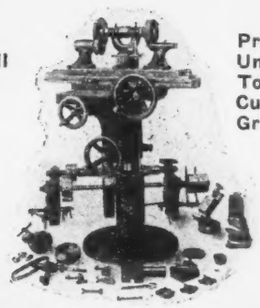
Simmons Open-side Planer
42" x 42" x 12"
Weight, 28,000 lbs.

Price,
**$435**



17" Crank Shaper
Weight, 1,750 lbs.

Price with All Attachments, **$485**



Premier Universal Tool and Cutter Grinder

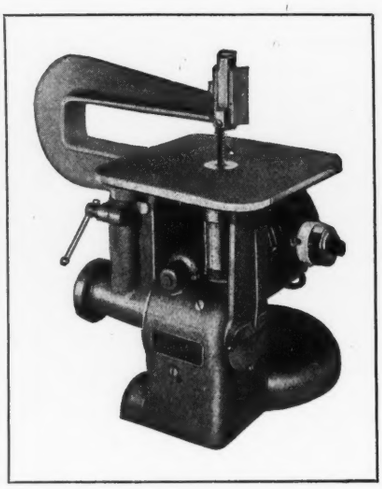
## SIMMONS MACHINE COMPANY
INCORPORATED

**ALBANY**

BRANCHES: 801 Singer Building, New York, N. Y. 358 Ellicott Square, Buffalo, N. Y. 804 Dime Bank Bldg., Detroit, Mich.

**NEW YORK**

# OLIVER
## Sawing, Filing and Lapping Machine



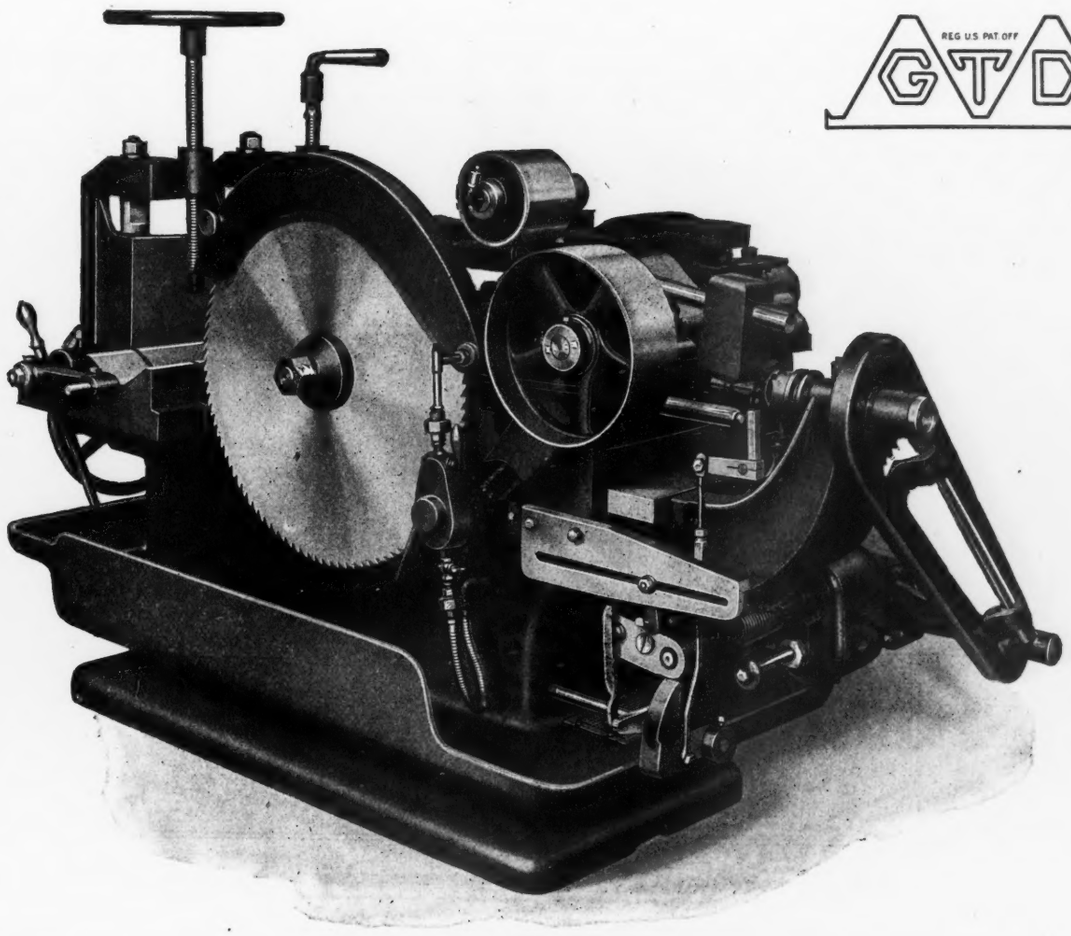
## Helps the Robbins & Myers Company Make Good Motors

The Robbins & Myers Co., Springfield, Ohio, operating one of the best equipped tool rooms in the Middle West, does much important work on the Oliver Filing Machine. The picture shows the filing of a die for the armature laminations of an automobile starting motor.

Robbins & Myers quality is nationally known, and the tremendous quantities in which their output is made require the best in both manufacturing and tool making equipment. The Oliver Sawing, Filing and Lapping Machines in this plant have several other machines in competition with them; but they more than hold their own as evidenced by the fact that two more of these machines have just been added to the installation. Many kinds of dies and forming tools of elaborate contour are made on the Oliver; and for the final lapping of dies which close in hardening, the Oliver Machine, equipped with an oil stone, meets every requirement.

***Find out today how an Oliver will speed YOUR work. Write.***

## OLIVER INSTRUMENT COMPANY
**ADRIAN, MICHIGAN, U. S. A.**



REG. U.S. PAT. OFF.
GTD

# Nutter & Barnes Automatic Metal Cutting-Off Machine

**In Your Steel Shed Means**

More Profit
Cleaner Cuts
Bigger Production
Consistent Performance
Narrower Kerf (less waste)

*No. 39 Machine Tool Catalog tells all about it. Got yours?*

MACHINE TOOL DIVISION

# GREENFIELD
## TAP & DIE CORPORATION
Greenfield, Massachusetts, U.S.A.

# CATARACT

## Cutting and Drawing Compounds

*3A*
*Acme*
*Mystic*
*Special*

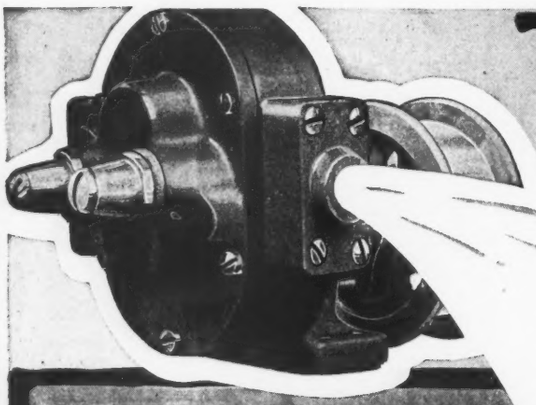
High grade lubricants for all classes of machining and grinding. Cataract Cutting Compounds

1. increase the cutting life of tools;
2. improve the quality of the work;
3. lower the cost of output;
4. do not injure operator's hands;
5. do not separate or become rancid;
6. do not rust or gum machine or work.

*Try a sample barrel of the kind best suited to your needs.*

## CATARACT REFINING & MFG. COMPANY

General Offices: Marine Trust Co. Bldg., Buffalo, N. Y. Plants: Buffalo—Chicago. Eastern Division, 17 Battery Place, New York City. Western Division, 327 So. LaSalle St., Chicago. Warehouses: New York, Detroit, San Francisco, Toronto, London, Eng.



# TRAHERN PUMPS

## Gisholt Machine Co. Another Big User

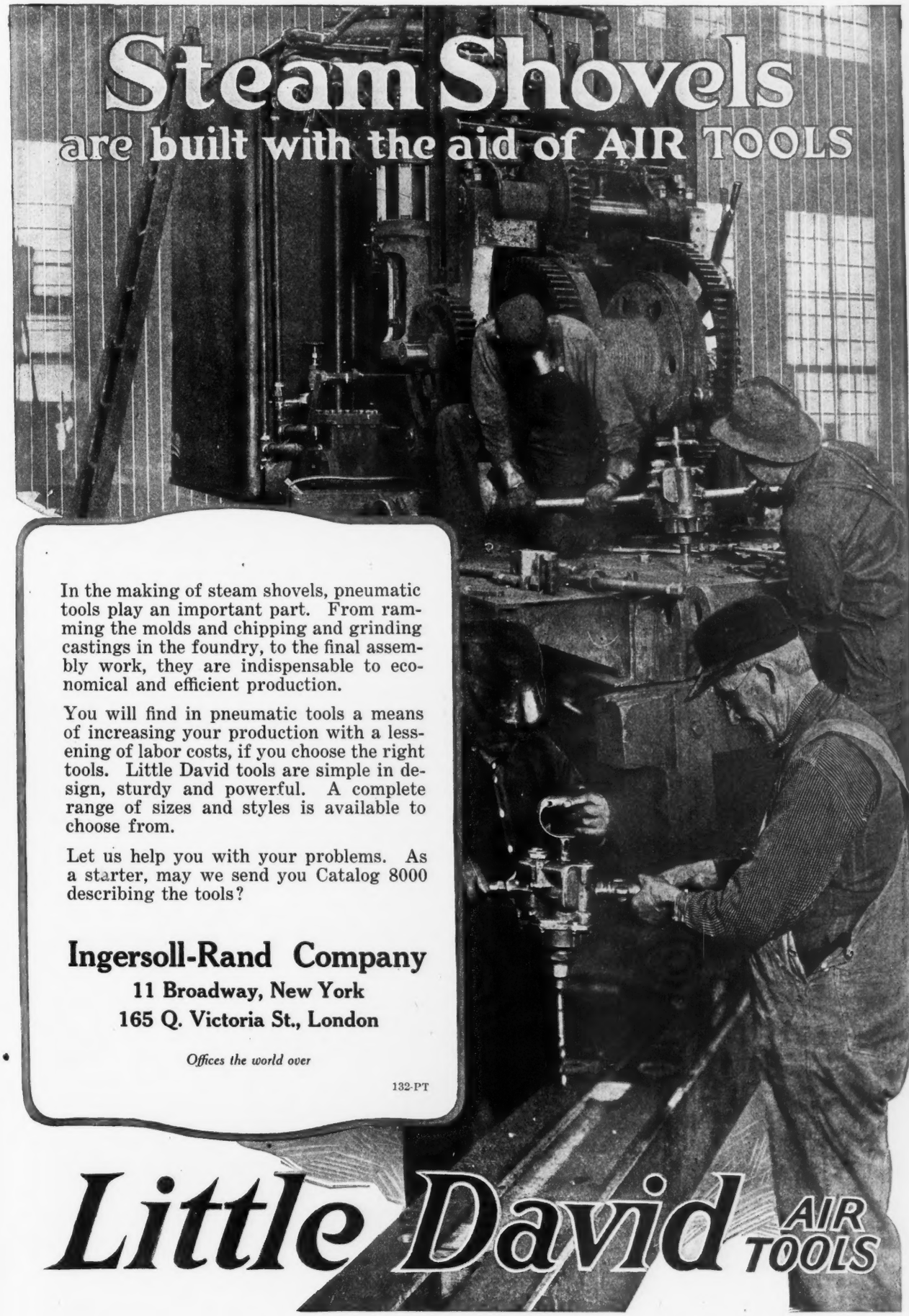
Those famous Gisholt turret lathes known throughout the country as the most economical equipment for big production, are equipped with Trahern Rotary Geared Pumps. The Gisholt Machine Company's products are dependable, so only the best was good enough. Trahern Pumps assure a full, continuous stream of coolant to the cutting tools with or without pressure.

They furnish the proper amount of coolant free from pulsation at the will of the operator. It is not necessary to operate them at high speed to obtain a steady stream.

Let us tell you how Trahern Pumps can be applied to your equipment or if you manufacture machine tools, to them. Write for catalog.

**TRAHERN PUMP Co.**
**ROCKFORD ILLINOIS**

# Steam Shovels
## are built with the aid of AIR TOOLS



In the making of steam shovels, pneumatic tools play an important part. From ramming the molds and chipping and grinding castings in the foundry, to the final assembly work, they are indispensable to economical and efficient production.

You will find in pneumatic tools a means of increasing your production with a lessening of labor costs, if you choose the right tools. Little David tools are simple in design, sturdy and powerful. A complete range of sizes and styles is available to choose from.

Let us help you with your problems. As a starter, may we send you Catalog 8000 describing the tools?

**Ingersoll-Rand Company**

**11 Broadway, New York**

**165 Q. Victoria St., London**

*Offices the world over*

132-PT

# Little David AIR TOOLS

# ELECTRIC ARC WELDING

PARTIAL LIST OF USERS OF THE MEPHISTO WELDER

New York Central Railroad
Pennsylvania Railroad
Lehigh Valley Railroad
Wheeler Condenser & Eng. Company
Standard Parts Company
Submarine Boat Corporation
American Int. Corporation
Crucible Steel Company

Low First Cost
No Moving Parts
Welds Cast Iron or Steel
Air-cooled Without Fan

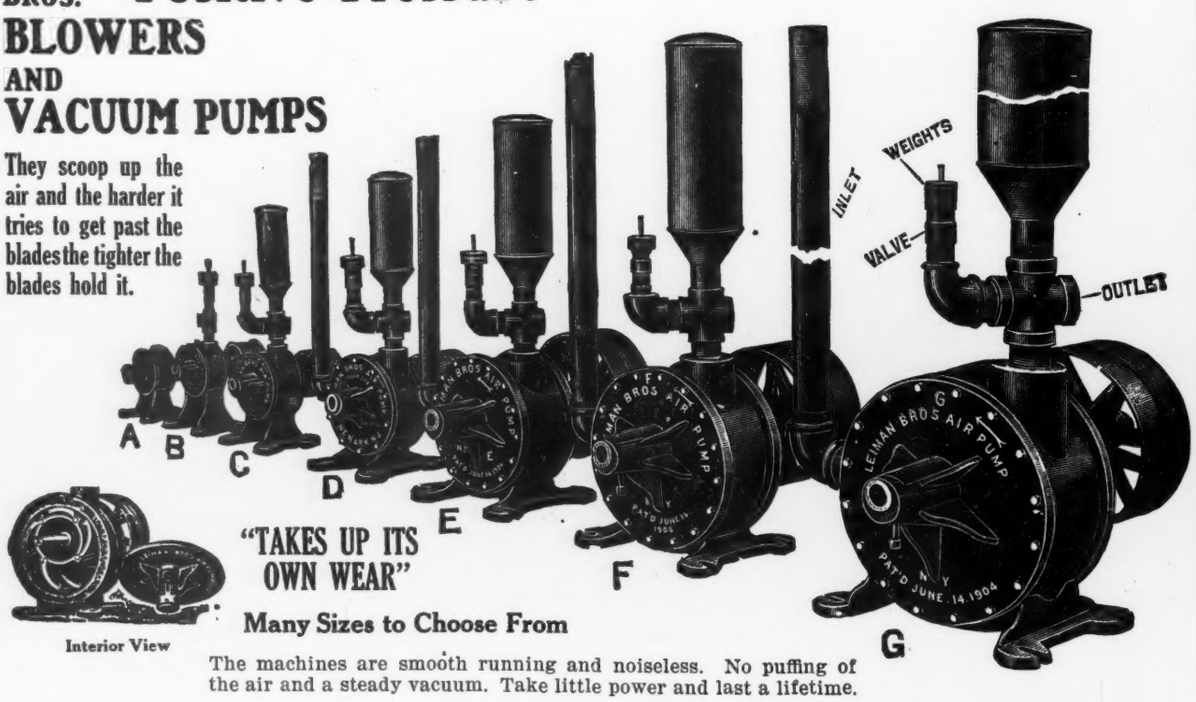
Efficiency over 90%. Power Consumption 3¼ to 4 K. W.
Operates on A. C. of any specified voltage or frequency. *Send for Booklet.*
***Send for Samples of our Covered Welding Rods***

# THE ARCWELL CORPORATION

42 BROADWAY, NEW YORK CITY

**LEIMAN BROS. Positive Pressure BLOWERS AND VACUUM PUMPS**

**They scoop up the air and the harder it tries to get past the blades the tighter the blades hold it.**






Interior View

**"TAKES UP ITS OWN WEAR"**

**Many Sizes to Choose From**

The machines are smooth running and noiseless. No puffing of the air and a steady vacuum. Take little power and last a lifetime.

Used with furnaces, blowpipes, sandblasts, bottle filling machines, ruling machines, printing presses for feeding by suction—automatic machines of every kind for pressure and vacuum.

**LEIMAN BROTHERS, 62 E-2 John Street, New York**

# HAMILTON

## POWER EQUIPMENT

## PUMPING STATIONS

The most efficient and economical Steam Engine for Municipal Work—for pumping water and sewerage or driving dynamos for lighting plants—is a "Hamilton."

Not only are we qualified by seventy-four years of engine-building—and by experience with countless municipalities—but also by our constant contact with every manufacturing center and industry the world over.

The constant demand for higher efficiency and economy we have answered by producing better "prime movers"—units better suited to each purpose, then any engine that had gone before.

Ordinarily we produce every part of "Hamilton" Engine from billets to finished product—we control every operation—we eliminate all shifting of responsibility. Practically every part is produced under our own inspectors—and is fit for the highest use.

It is these facts that make "Hamilton" a synonym for quality wherever Steam Engines are used.

Hamilton Steam Engines are best by the test of use.

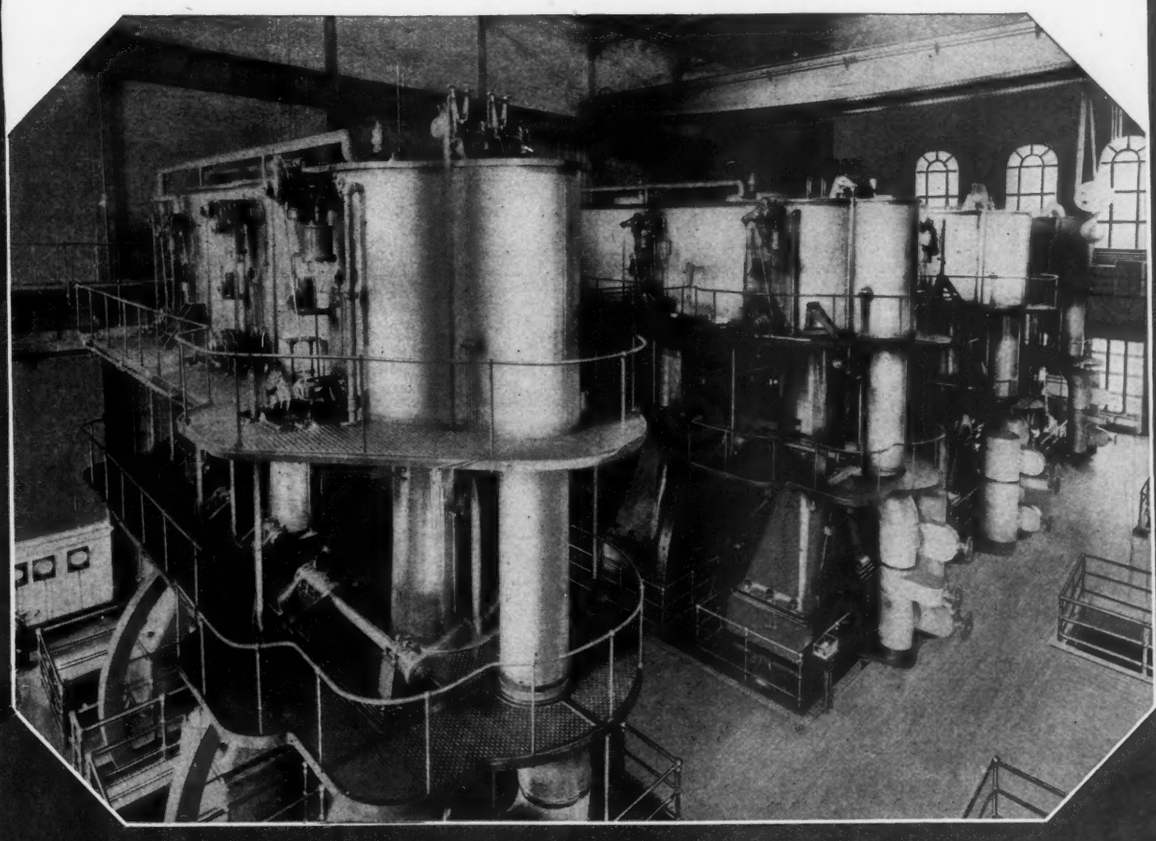
*Offices in All Important Cities*

**The Hooven, Owens, Rentschler Company**

*Producers of Prime-Movers for All Industries*

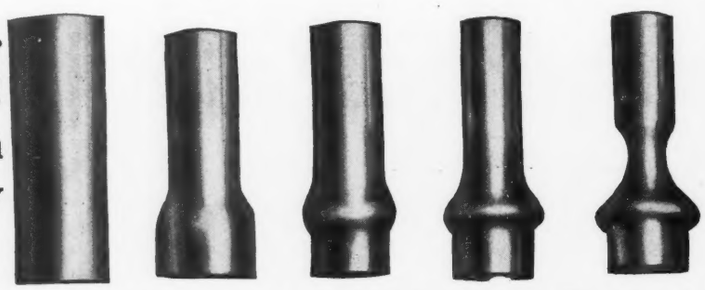
**Hamilton, Ohio**

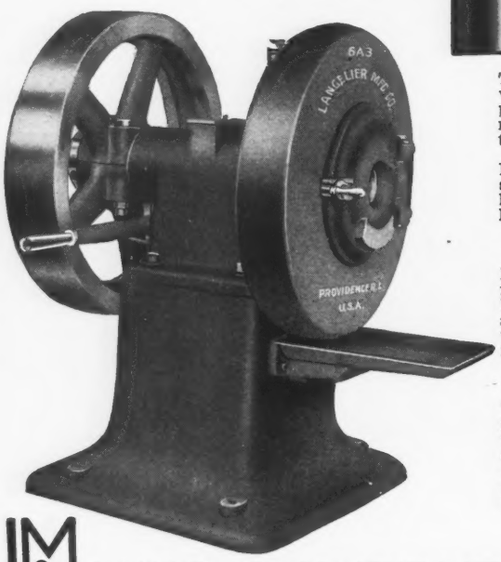
*Pumping Engine, Four Vertical Triple Expansion Units, for the Ridgewood Pumping Station, Brooklyn, New York.*



# Rotary Swaging

## Will Accurately Form Metal With Economy






The Langelier Reducing or Swaging Machine forms different metals without wasting any of the material. It improves the stock by compression, besides preserving same metal on the surface—the best metal—which with any other machine is cut away. In addition to this big economical feature, it is more accurate and more rapid.

In working extremely hard metal, we arrange **these machines to swage the metal hot** doing much of the work formerly done by trip hammers at a very much higher rate of production, with unskilled labor, at lower cost and with greater accuracy.

### 3000 Blows A Minute Must Mean Rapid Work

Revolving dies are within the round casing in front. These dies are forced on the work by a succession of sharp blows from the hammer blocks behind the dies. These striking at the rate of about 3000 blows a minute reduce the material, such as drill rod, tubing, copper, etc., with great rapidity. The machine is perfected to give absolutely uniform and well finished work.

### A Special Machine For Your Special Work

We build these machines in eight different sizes to take solid stock from pin wire up to 2 inches diam. and tubing up to 4 inches diam. We will study your work and build machines especially for it, to be operated by unskilled labor, producing the blow best adapted to secure the desired results, according to the nature of the material to be worked, its size and amount of reduction, and whether solid or hollow, hot or cold.

***Write and tell us about the work you want done — sending samples or blue prints***

**LMCo. LANGELIER MANUFACTURING CO., Arlington, Cranston, R. I., U. S. A.**

# Yeakley Vacuum Hammers

*Write for full description*

Very much improved hammer. No check valves used. Simple operating mechanism. Delicate adjustment of blow, either by hand or foot treadle, or both. Direct connected motor or belt drive. Light and heavy blows delivered at same speed.

**Williams, White & Co.**
**Moline, Ill.**

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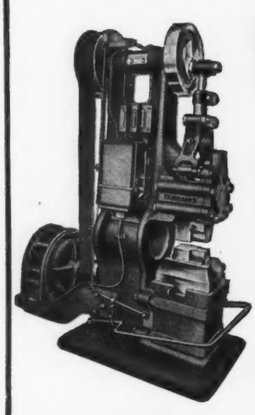
NEW YORK OFFICE: C. H. Holbrook, 30 Church St.
DETROIT OFFICE: J. C. Austerberry, 65 Shelby St.

# Drop Presses

*for all purposes our specialty*

*The*
**Peck Drop Lifter**
**can be readily applied to foot or hand drops.**

**MINER & PECK MFG. CO.**
*Proprietors of the PECK DROP PRESS WORKS*
NEW HAVEN CONN., U. S. A.



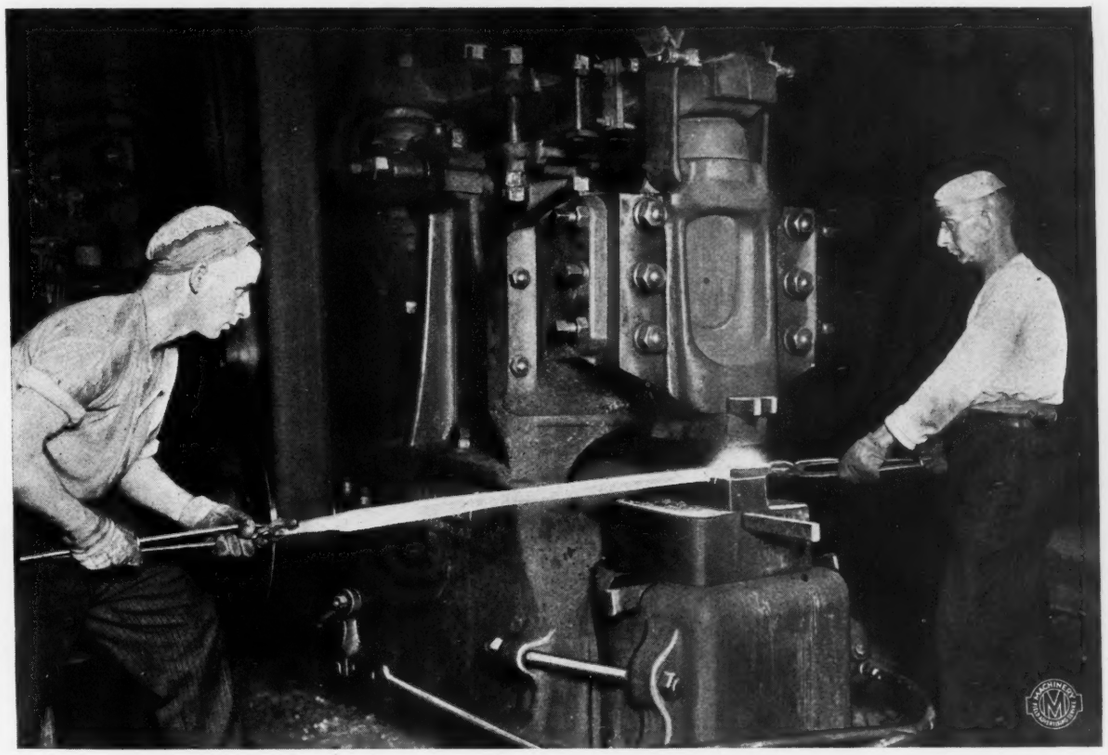
# FAIRBANKS HAMMERS

**25 to 300 lbs.**
**BELT OR MOTOR DRIVE**

These Hammers Embody a Design and Workmanship that are unsurpassed.

*Send for Catalog*

**UNITED HAMMER CO.**
OLIVER BLDG. BOSTON, MASS



# BRADLEY HAMMERS

## *Always Forging Ahead*

The plant in which this Bradley Hammer is working is that of a new concern, which is rapidly forging ahead. Good equipment permits remarkable progress. The Bradley Hammer is an im portant unit in this plant's equipment.

The photograph shows the "cogging down" and finishing of the smaller sizes of a fine quality of high speed steel. The service is continuous—as soon as one bar is finished, another is ready.

The operator says: "I have been running that hammer for over five months and haven't had a particle of trouble. It certainly does great work."

## Helping This Company to Forge Ahead Also

***Let the Bradley Hammer help YOU forge ahead. Send for specifications.***

**C. C. BRADLEY & SON, Inc.**

**SYRACUSE** *Established in 1832* **NEW YORK**

FOREIGN AGENTS: Brazil, France, Belgium, Italy, Switzerland, Spain and Portugal; Fenwick Freres & Co., 8 Rue de Rocroy, Paris. England, Buck & Hickman, Ltd., London.

# D & E HAMMERS *Disston's Choice*

One of the quickest and best ways of judging a machine tool without seeing it is to find out who uses it. When the best companies in America, whose reputation for output and quality are unquestioned, choose D & E Hammers it is because they believe these hammers will serve them best. The illustration shows the interior of a plant whose products have a world-wide market—Henry Disston & Sons, Inc., of Philadelphia. Forty D & E Hammers in the File Making Department alone point, tang and otherwise help manufacture files. D & E Hammers ranging in size from 25 to 250 lbs. are found all over this great plant, the first one being installed 35 years ago.

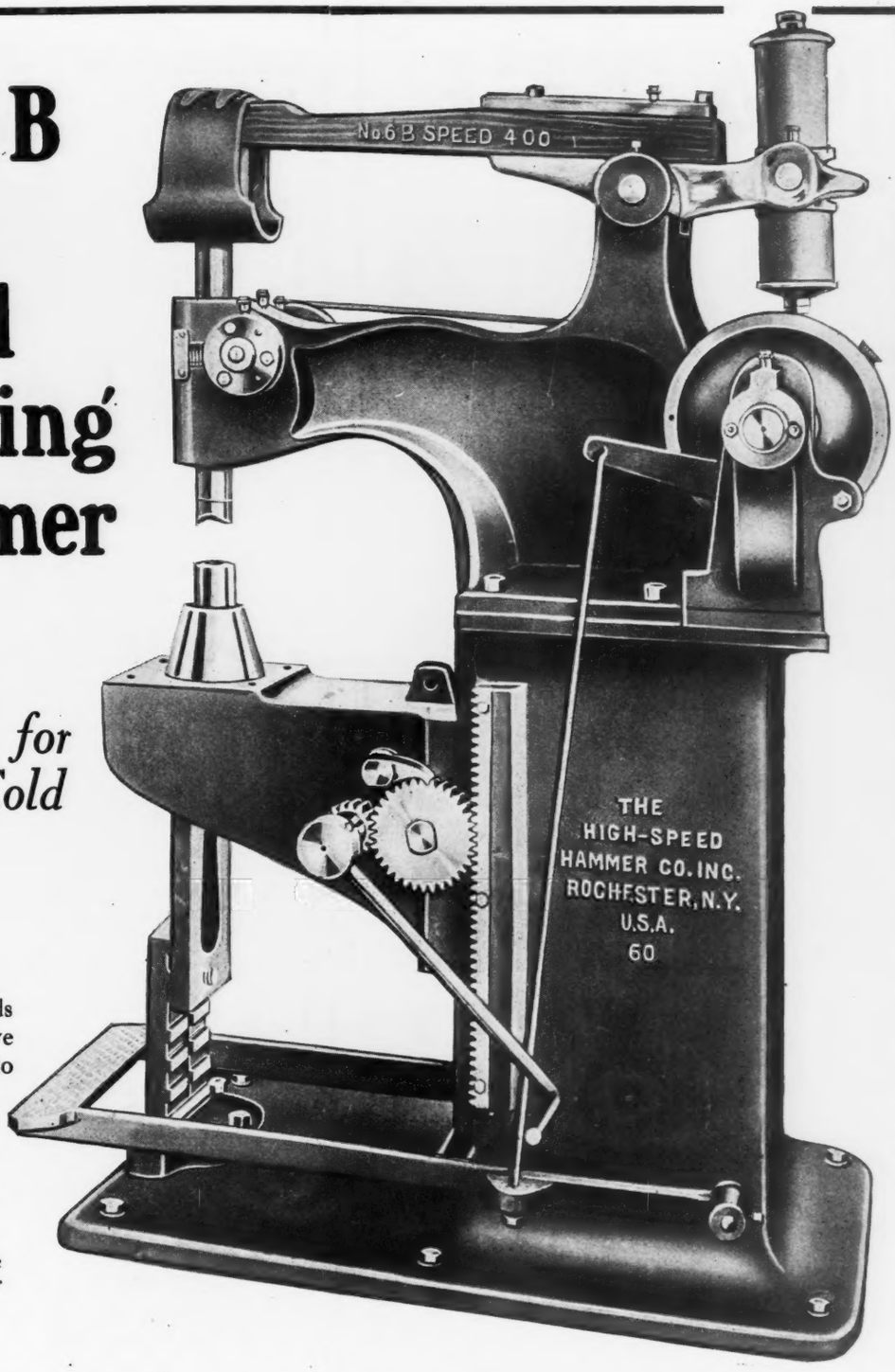
***D & E Hammers may solve your problems. Let us help you. Write***

**DIENELT & EISENHARDT, Inc.,**

**1304 NO. HOWARD ST. PHILADELPHIA**

# No. 6 B High Speed Riveting Hammer

*Specially Designed for Heavy Cold Riveting*




**Capacity**

Full Round Heads
5/8" to 3/4" inclusive
Oval Heads 7/8" to
1½" inclusive.

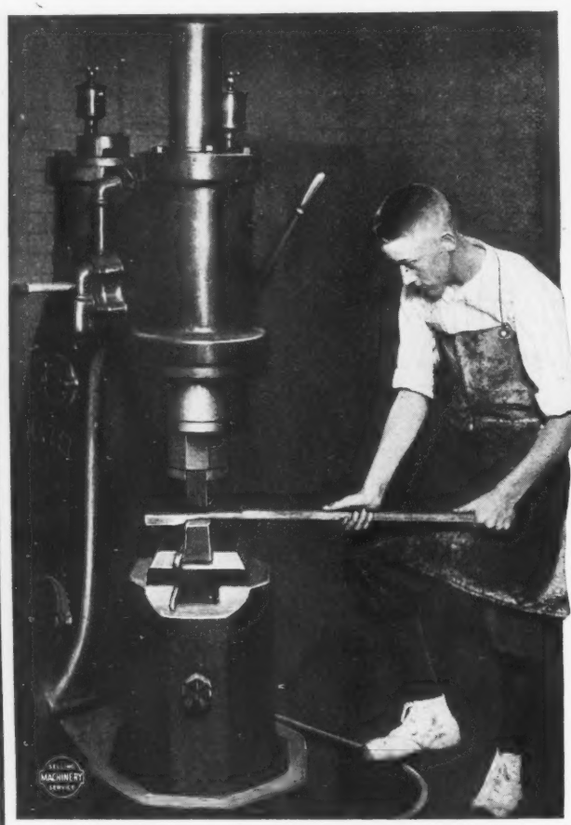
***Write for more details. Send samples or prints of your work and let us shoulder your riveting problems.***

In this, the newest product of the High Speed Hammer Company, Inc., the field of cold riveting has been considerably extended. The weight of this High Speed Riveting Hammer—1½ tons—is sufficiently great to enable it to stand the vibration to which it will be subjected. The bronze vibrator, through which all shock is transmitted to the hickory helve, does away with rigid motion or striking of parts should excessive vibration develop. Special ball thrust bearings are used in connection with eccentric and rear main shafts, and a special type of Hyatt roller bearings is used for eccentric and strap.

## The High Speed Hammer Co., Inc.

**ROCHESTER, N. Y., U. S. A.**

# NAZEL



# HAMMER

**Knowledge Is Power**

If the young idea is mechanically bent part of its shooting is taught on the Nazel Hammer in the original Gary School at Gary, Indiana.

That a Nazel Hammer was selected for the important work of education proves that a Nazel is simple, safe and durable. In the five and a half years this hammer has been in use not a cent has been spent for repairs, not an injury has been sustained by its youthful operators.

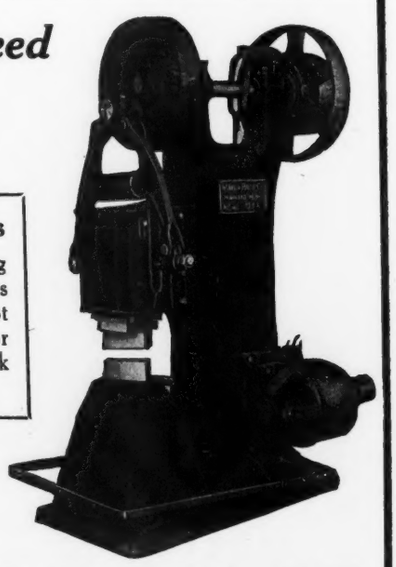
You too can learn something from the Nazel. Send for the circular today and see how.

**Knowledge of Power**

**NAZEL ENGINEERING WORKS**
**4043 N. Fifth Street, Philadelphia, Pa.**

*Guaranteed Forever*

**Special Dies**
for any forging purpose. Prices quoted on receipt of drawings or samples of work to be done.



Motor Driven Model

# LITTLE GIANT Power Hammers

are *guaranteed forever against defective material and workmanship.* There are more than 8000 in daily use, and we know of none ever having gone to the scrap heap.

Durability is combined with machine gun rapidity and precision—vibration is eliminated.

Annual repair sales for all Little Giant Power Hammers in use, from the first one sold 26 years ago to the latest, averaged 48 cents each, or less than two-fifths of 1 per cent of original hammer cost to purchaser.

All sales are made subject to return at factory expense within 30 days after arrival of shipment if for any reason unsatisfactory to purchaser.

Belt Driven Model

*Five Models Prompt Shipments*

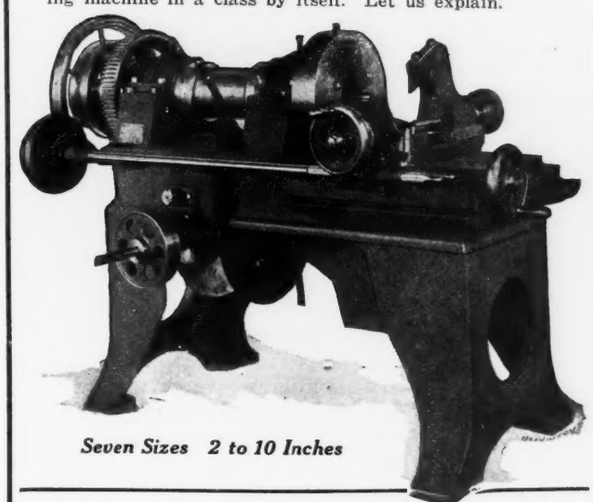
**LITTLE GIANT COMPANY**

**131 Rock Street**
**MANKATO**
**MINN., U.S.A.**
**Established A. D., 1876**

## The Hurlbut-Rogers Cutting-Off Machine Has Seven Distinctive Advantages

1. Patent device for working two tools in same cut.
2. Inclined tool block giving shearing cut.
3. Patent adjusting nut on one tool block.
4. Patent receptacle for chips and oil.
5. Patent belt shifter, independent of friction.
6. The centering attachment.
7. Accelerated speed.

Each point is developed to ultimate efficiency and all combine to put this automatic cutting-off and centering machine in a class by itself. Let us explain.



*Seven Sizes 2 to 10 Inches*

**The Hurlbut, Rogers Machinery Co.**
SOUTH SUDBURY, MASS.

## HEAVY DUTY SWAGERS

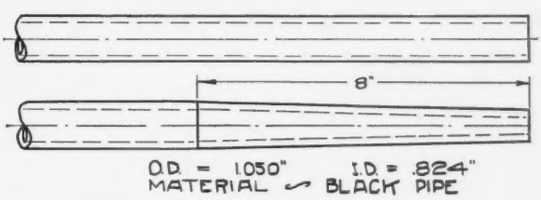
For tapering or reducing solid stock or tubing our 4A Swager has no peer. It has a maximum capacity of 2½" on tubing and 1½" on solid stock. The die is 8" long.

As the machine is operated at 275 R.P.M., it can be economically used on small work as well as large.

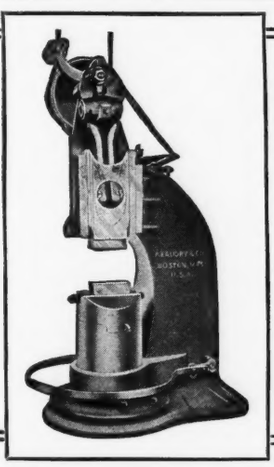
## 500 PIECES PER HOUR

A typical sample of 4A Swager work which is done in one operation. This piece is reduced from 1.050" to .750" in an 8" straight taper.

*Circulars on request*




**THE ETNA MACHINE COMPANY**
Maplewood Avenue and Castle Boulevard TOLEDO, Ohio, U. S. A.



## BEAUDRY HAMMERS
**For General Forging**

**Save Fuel, Time and Labor. Cut Forging Costs in Two.**

*Belt or Motor Driven*

**BEAUDRY & CO.**
Incorporated
141 Milk St., Boston, Mass.

## CHAMBERSBURG HAMMERS
STEAM DROP—BOARD DROP—SINGLE AND DOUBLE FRAME TYPES
*All Sizes for Every Class of Forging Work*
HYDRAULIC MACHINERY
**CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa.**
*Send for Catalog*

## MERRELL Pipe Threading and Cutting Machinery
*Hand or Power Operated*
**THE MERRELL MFG. COMPANY**
15 Curtis Street TOLEDO, OHIO

**Are You Familiar with the Advantages of Swaging with the**
## Dayton Swaging Machine?

Do you know that this process for drawing, pointing, tapering and otherwise reducing metal improves its quality and surface and is more economical than turning, grinding, etc.?

**The Torrington Company**
**Excelsior Plant**
Successor to Excelsior Needle Co.
**Torrington Conn.**

Coventry Swaging Co., Ltd., White Friars Lane, Coventry, England, Agents for Great Britain. Fenwick Freres & Co., 8 Rue de Rocroy, Paris, France, Agents for France, Italy, Belgium, Spain, Portugal and Switzerland.

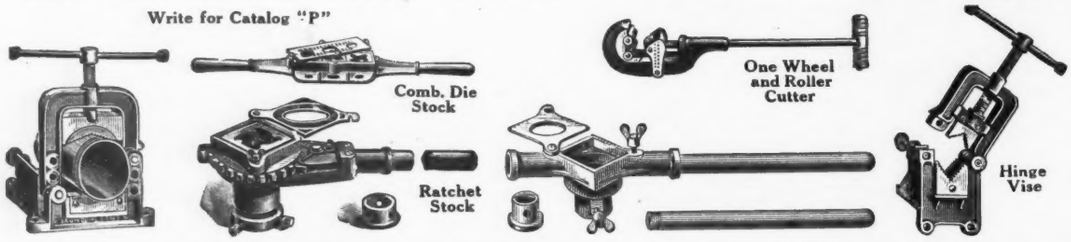
*We've a booklet that tells all about it. Write for it today*

**No. 3 Machine**

**Capacity 0" to 2"**

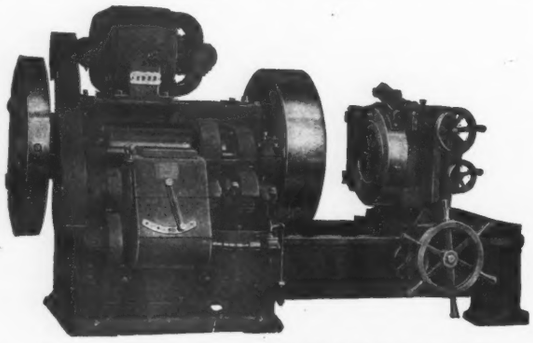
## Saunders' Tools Will Stand the Strain. They Are the Result of Sixty Years' Practical Experience

Write for Catalog "P"




**D. SAUNDERS' SONS, YONKERS, N. Y.**

## The Method of Drive is an Important Thing in a Pipe Machine



Because a lot of time is wasted if the speed is not just right for every size and material of pipe

## The "Stoever" Pipe Machine

has a single-pulley drive with gear speed variation. This means that the belt speed is constant, not lowest when it should be highest. The belt tension is always proportional to the power transmitted—economy of power. The belt contact is constant and always adequate.

The "Stoever" has a friction countershaft which eliminates shifting belts and saves at least one-third in belting cost.

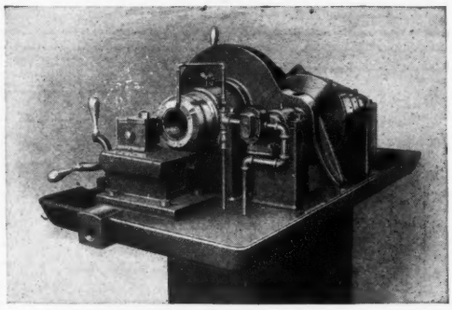
The gear speed variation affords a speed exactly right for every size of pipe and for iron or steel. This means maximum cutting and threading speed.

Write for the "Economy" Booklets

TREADWELL ENGINEERING CO.
EASTON, PA. TE 10

## *If You Want a Cutting-Off Machine*

That cuts tubular and solid stock squarely and cleanly
That leaves so little burr, reaming is usually unnecessary
That has long carefully scraped solid bronze bearings
That has six changes of speed to handle stock in all conditions
That is an eight year success



*Buy a* MODERN MACHINE TOOL CO.
JACKSON MICHIGAN

# MODERN

Standard Wieland 6-inch Pipe Threader and Cutter

## Thread Pipe Do You? How?

The modern, efficient way is the Standard Wieland way, with a heavy, sturdy, durable machine, simple and positive in operation, fast and accurate in production.

A few features: One-piece bed; single-speed pulleys; gear speed changes through semi-steel cut gears; deep chasers, cutting long taper threads in one cut perfectly, steel as well as iron pipe.

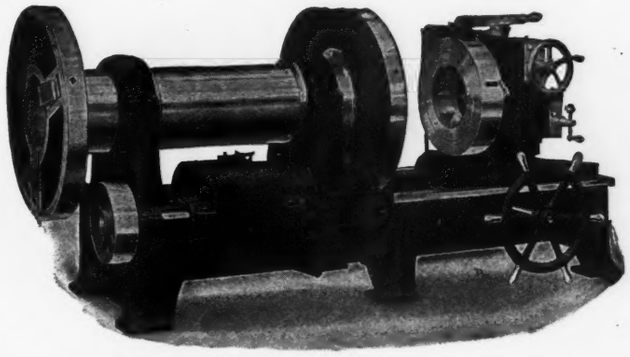
Send for the Circular.

## Standard Engineering Company

ELLWOOD CITY PENNSYLVANIA

San Francisco Office: 1801 Claus Spreckles Bldg.

PEERLESS B&K DUPLEX P·D·Q·C



The Improved

# PIPE MACHINES

Requisites for any machine are: that it will do the work well, will be durable and that it can be conveniently operated. The construction of the Peerless die-head, with which all B & K pipe machines are equipped, insures good threads. Equipped with good chucks—three styles—good gear-box and an excellent oiling system, these machines produce threads that make tight joints.

*Catalog?*

## BIGNALL & KEELER MACHINE WORKS

EDWARDSVILLE, ILLINOIS

PEERLESS B&K DUPLEX P·D·Q·C

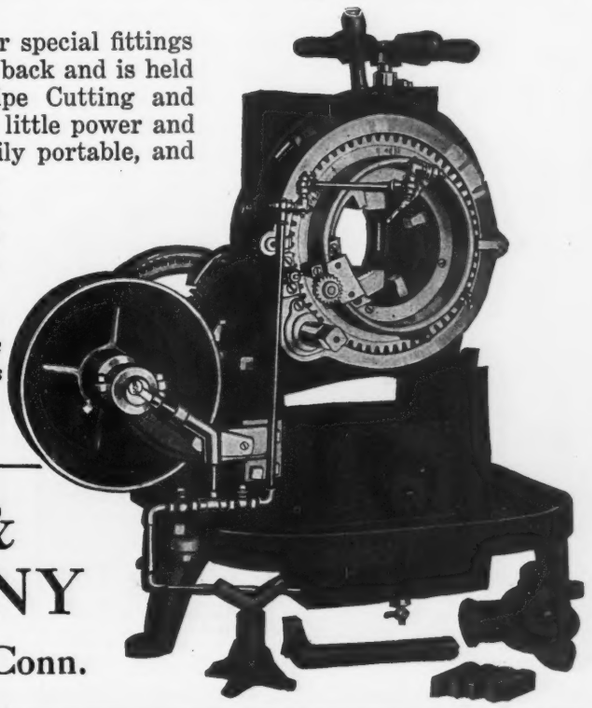
## —— We Sell Service ——

# Forbes Pipe Cutting and Threading Machines

Self-contained machines that need no vises or special fittings to hold the pipe, which enters the dies at the back and is held rigid by a self-centering vise. Forbes Pipe Cutting and Threading Machines take up little space, use little power and need only a single operator. They are readily portable, and all machines can be hand operated in emergency; they are simple in construction, economical in operation, satisfactory in results and the first cost as well as the cost of operation is exceptionally low.

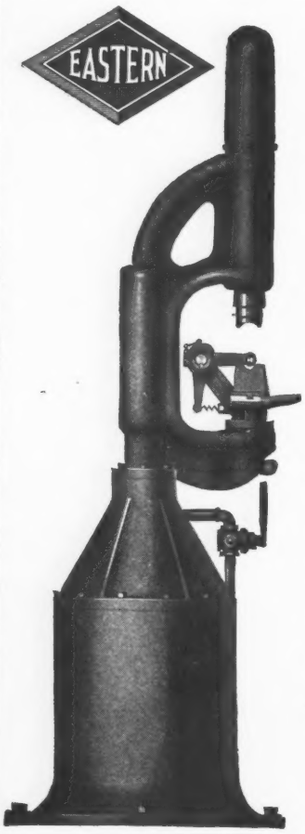
***If you're in the market for a pipe machine and want service—ask us about the Forbes***

***Sizes to cut pipe from ¼" to 15"***



## THE CURTIS & CURTIS COMPANY

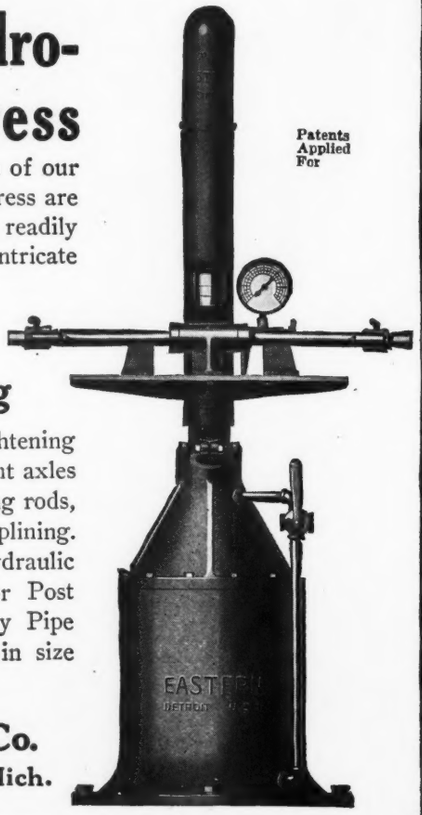
8 Garden Street Bridgeport, Conn.




# A Simpler Hydro-Pneumatic Press

Complications in the construction of our High Speed Hydro-Pneumatic Press are so few that its operation is more readily understood than that of a more intricate machine.

Patents Applied For



## Straightening Forcing, Broaching

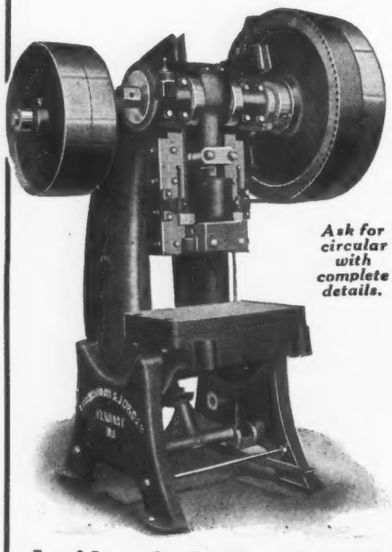
Particularly adapted for straightening cam, crank and wheel shafts, front axles and bar stock, Broaches connecting rods, cylinder block tappet holes and splining. We manufacture a full line of Hydraulic Fittings, Check valves, Indicator Post gates, O. S. and Y. valves, Dry Pipe valves, etc., with a wide range in size and pressure capacity.

**Eastern Production Co.**
**137 Leib St. Detroit, Mich.**

COMBINATION - OPEN BACK - INCLINABLE

# The L-J No. 5 Press

## Fast, Safe and Convenient



*Ask for circular with complete details.*

The newest of a big line of presses.

A favorite with the men, because it's fast, safe and convenient.

A few of its many features are massive frame, exceptionally large shaft bearings, solid web flywheel with removable bushings and wick oil bearing caps.

**Loshbough-Jordan Tool & Machine Co.**
**ELKHART INDIANA, U. S. A.**

Stocker-Rumely-Wachs Co., Chicago, Ill.; W. J. Baird Machinery Co., Detroit, Mich.; Herberts Machinery & Supply Co., Los Angeles and San Francisco, Cal.; J. L. Lucas & Son, Inc., Bridgeport, Conn.; Brown-McDonald Machinery Co., St. Louis, Mo.; Northern Machinery Co., Minneapolis, Minn., and Duluth, Minn.; Clark Machinery Co., Cleveland, Ohio; Patterson Tool & Supply Co., Dayton, Ohio; Dale-Brewster Machinery Co., New York, N. Y.; Swind Mchy. Co., Philadelphia, Pa.

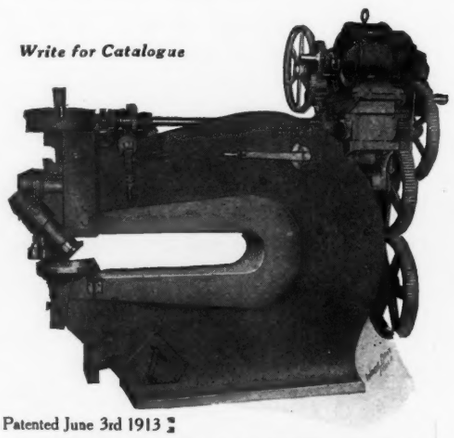
"QUICKWORK"
Registered U. S. Patent Office

# *Rotary Shears*

**MADE IN SIX SIZES**

Cut all gauges of sheet and plate metal up to 1 inch thick in straight or irregular shapes and openings without cutting in from side of sheet. Leaves square true edge that requires no finishing. Used in building ships, boilers, tanks, cars and general plate and sheet metal work.

*Write for Catalogue*



Patented June 3rd 1913

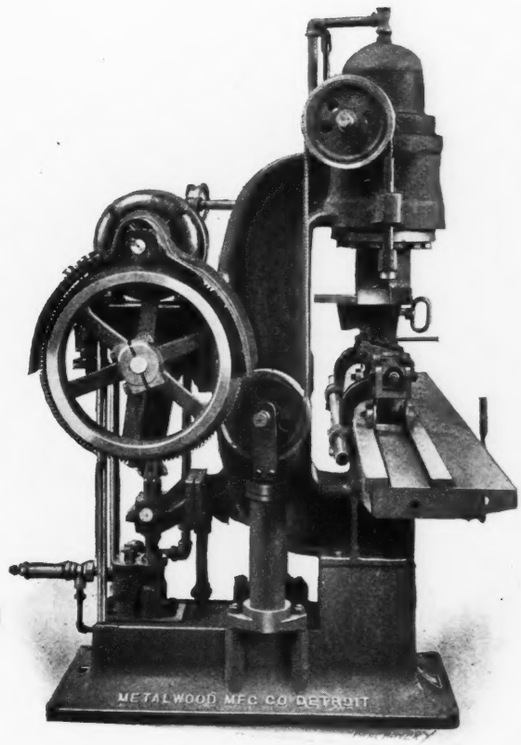
**SAVES 50% TO 90%**
Eliminates Oxyacetylene Cutting and Plate Planing

# THE QUICKWORK CO.

**ST. MARYS OHIO, U. S. A.**

# ORIGINALITY

is characteristic
always of
METALWOOD
designs and
developments




Our records show a strikingly large percentage of the sales of this "Metalwood" No. 191 Crankshaft Straightening Press to be in the REPEAT ORDER Classification.

A complete description is given in our bulletin "B-48".

## METALWOOD MANUFACTURING COMPANY

**HIGH SPEED HYDRAULIC AND HYDRO-PNEUMATIC MACHINERY**

**DETROIT, MICH.**

**Exclusive Sales Representatives**

R. E. Ellis Engineering Co., 621 Washington Blvd., Chicago; Fairbanks-Morse & Co., Inc., 30 Church St., New York City; Sherritt & Stoer Co., Finance Bldg., Philadelphia; Canadian Fairbanks-Morse Co., Ltd., Montreal and Toronto.

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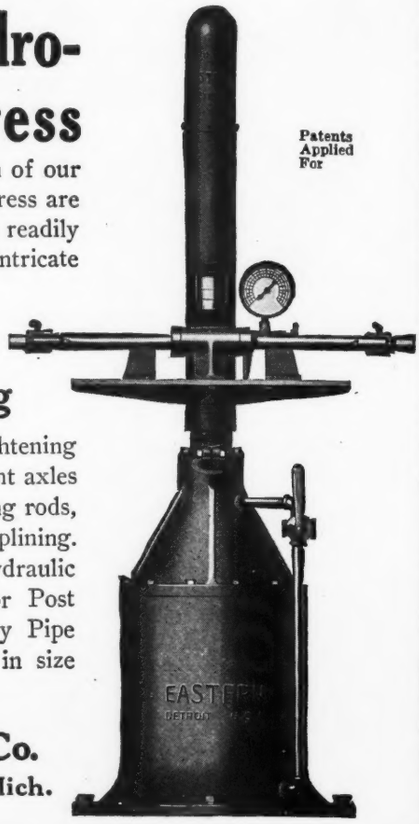


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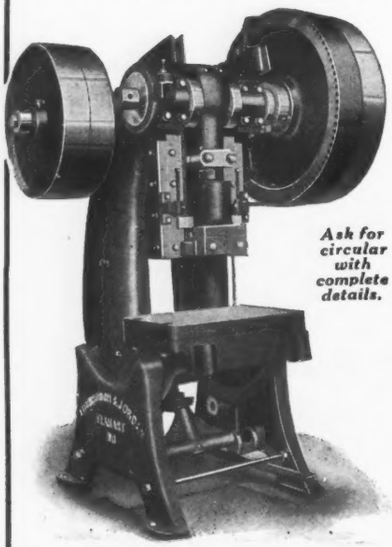

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The newest of a big line of presses.

A favorite with the men, because it's fast, safe and convenient.

A few of its many features are massive frame, exceptionally large shaft bearings, solid web flywheel with removable bushings and wick oil bearing caps.

**Loshbough-Jordan Tool & Machine Co.**

**ELKHART INDIANA, U. S. A.**

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**"QUICKWORK"**

Registered U. S. Patent Office

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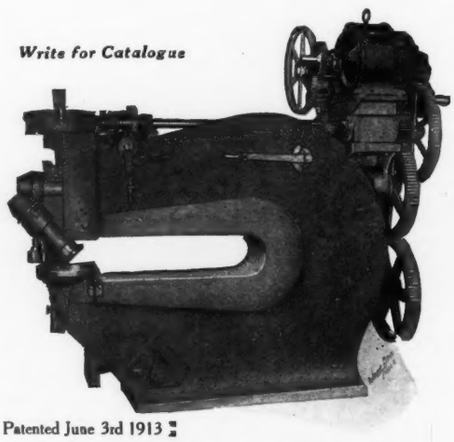
Cut all gauges of sheet and plate metal up to 1 inch thick in straight or irregular shapes and openings without cutting in from side of sheet. Leaves square true edge that requires no finishing. Used in building ships, boilers, tanks, cars and general plate and sheet metal work.

*Write for Catalogue*



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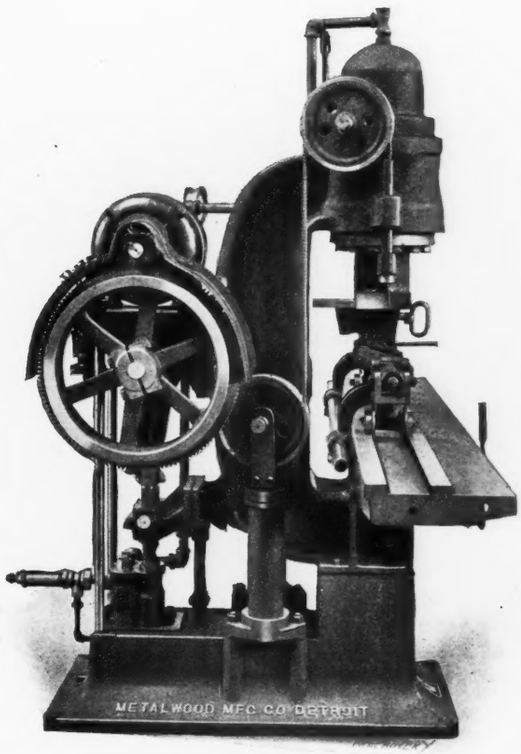


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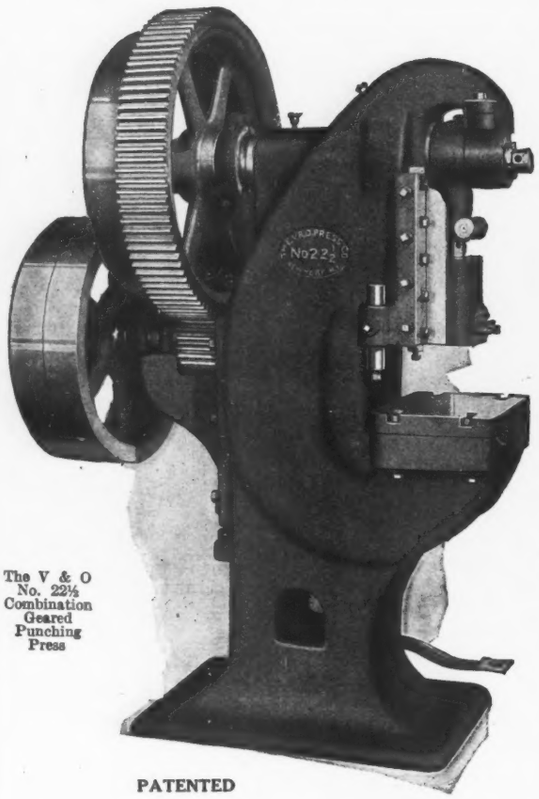
# V & O
## PUNCH PRESSES



The V & O No. 22½ Combination Geared Punching Press

PATENTED

## The Quickest Route to the Best Results

No one who is familiar with punch presses can have failed to observe the degree of sameness which characterizes most of them. Made in different plants, in different sections of the country, they might—with the exception of a very few minor differences—have been turned out of the same mold.

A mere glance at the V & O shows that no adherence to type has influenced its designers. Results—results only—were striven for; and the production figures of our clients show that the V & O has achieved them.

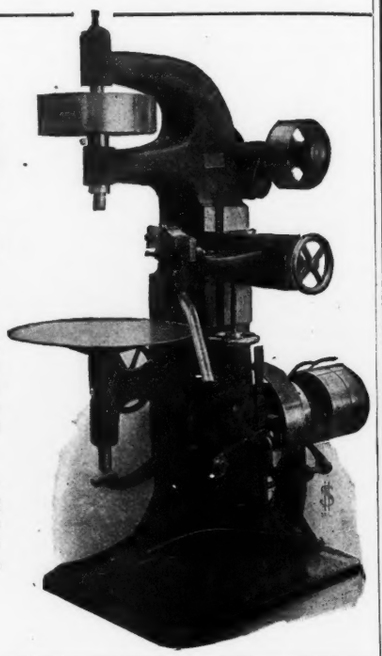
The V & O is massive, well proportioned—will handle a vast range of work.

The lost motion and knock which most presses develop after usage never occur in the V & O. The plunger end of the connecting rod is a ball working in a spherical chamber, and is readily adjusted for wear. *Write for details.*

**THE V & O PRESS CO.**
**100 Dry Harbor Rd., Glendale, Brooklyn, N.Y.**
PRESSES, DIES, SHEET METAL WORKING MACHINERY

# SWAINE

## No. 4 DOUBLE SEAMER is a Profitable Machine



It accommodates work up to 28" diameter and 21" in height and may be equipped with Duplex Heads to seam both ends at once.

Durable construction, speed and operating convenience make this machine profitable for a wide range of work.

*Details in catalog*

**FRED J. SWAINE MFG. CO.**
**7th and O'Fallon Sts. ST. LOUIS, MO.**
*Largest Press Builders in the West*

# FERRACUTE
## PRESSES

HUNDREDS OF SIZES AND STYLES FOR

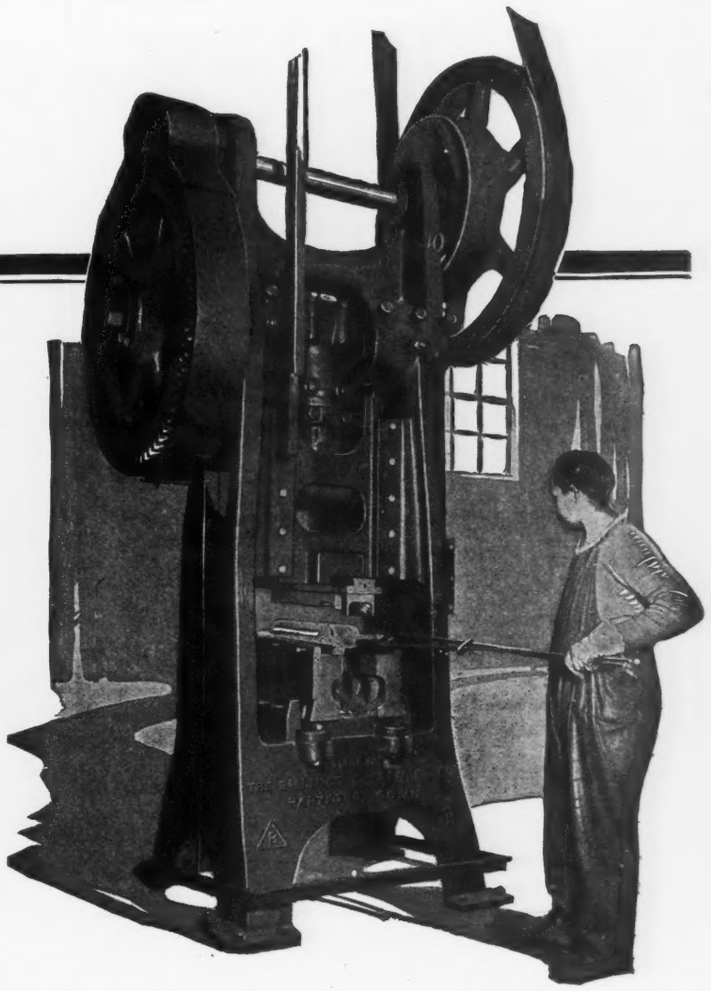
CUTTING, FORMING, DRAWING, PUNCHING, SHEARING, COINING and EMBOSSING

## SHEET METALS

Photographs and full information on request

Estimates furnished on receipt of samples or drawings

**Ferracute Machine Co.**
**Bridgeton, New Jersey**



# TRIMMING PRESSES

**and other forge shop machinery as developed in our own plant. Send for information.**

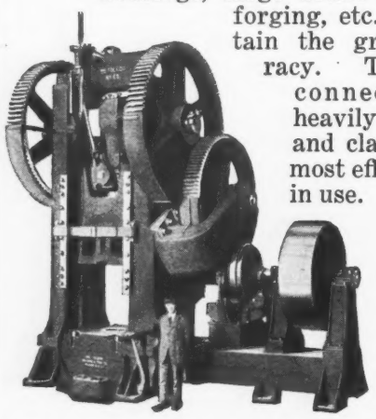
# The Billings & Spencer Co

Hartford

THE FIRST COMMERCIAL DROP FORGING PLANT IN AMERICA

# THE "TOLEDO"
## STRAIGHT COLUMN PRESSES

Exceptionally strong, rigid and well proportioned and of unusual energy and power. For work on Pullman cars and passenger coaches, tire cases, steel axle housings, large brake drums, cold forging, etc., they maintain the greatest accuracy. The massive connections are heavily reinforced and clamped by the most effective device in use.



Slides are very long and move in long and heavy gibs. Clutch is powerful and quick acting.

50 sizes weighing from 3,000 to 300,000 lbs.

*Many exclusive features add to the general superiority.*

**The Toledo Machine & Tool Co., Toledo, Ohio**

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST. NEW YORK, U.S.A.

PARIS TURIN ZURICH BARCELONA

# T — S
*Inclinable*
## POWER PRESS

No. 20—A new press of an old line.

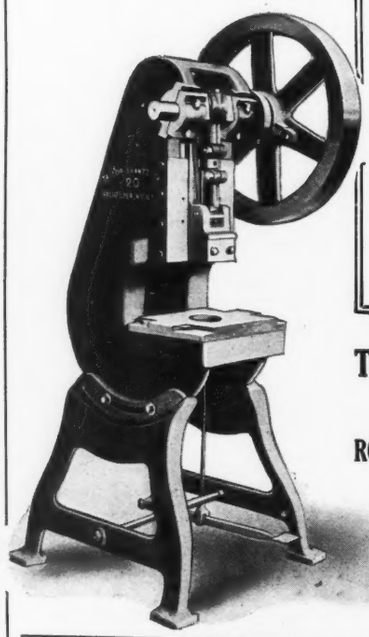
No. 20—fast, accurate, durable, economical.

Throat has been reinforced heavily.

Shafts may be turned to assist in setting dies while machine is in motion.

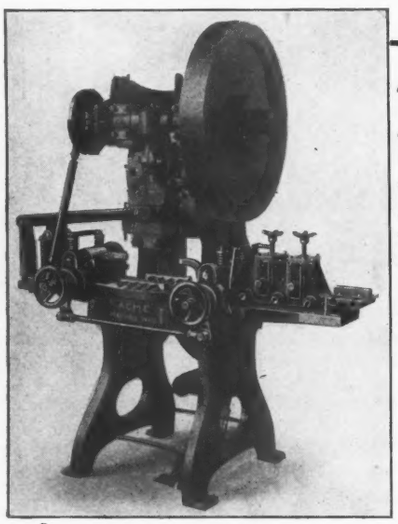
Press can not be tripped while slide is down.

***Send for all details***



**TAYLOR - SHANTZ COMPANY**
**ROCHESTER N. Y., U. S. A.**

*Precision maintained by the Johansson Gauging System*



No. 3 Double Roll Feed, Scrap Cutter and Straightening Attachment.

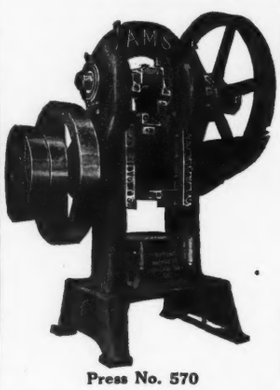
# Turn Your Presses Into Automatic Machines

Increase Production over hand feeding 100% to 300% on each press.

# ACME ROLL FEEDS

High speed, accurate, noiseless. Acme Roll Feeds are mounted on their own Bolster Plates which are made to fit all makes and sizes of presses. When Roll Feeds are fitted with Scrap Cutters they enable operator to run from two to three presses. Roll Feeds eliminate the danger of accidents, as operator is not near the dies.

**ACME MACHINE WORKS**
**4125 Ravenswood Ave. CHICAGO, ILL.**



Press No. 570

# PRESSES
**LARGE OR SMALL**
**REGULAR OR SPECIAL**
# "AMS"

***Let us quote you on your next press***

**THE MAX AMS MACHINE CO.**
**101 Park Ave. NEW YORK**

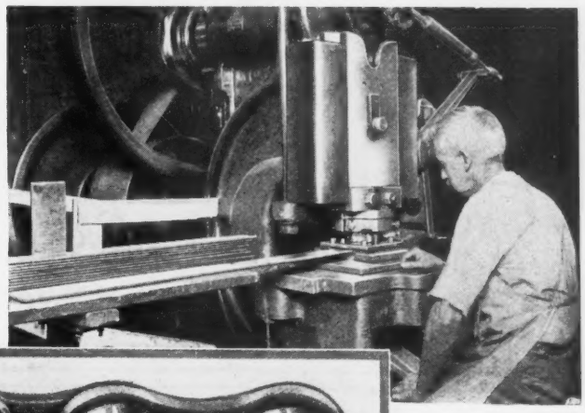
# PRESSES AND SHEARS
**SHEET METAL WORKING MACHINERY**
**THE D. H. STOLL COMPANY, Inc.**
**Military Road and Grote Street, BUFFALO, NEW YORK**

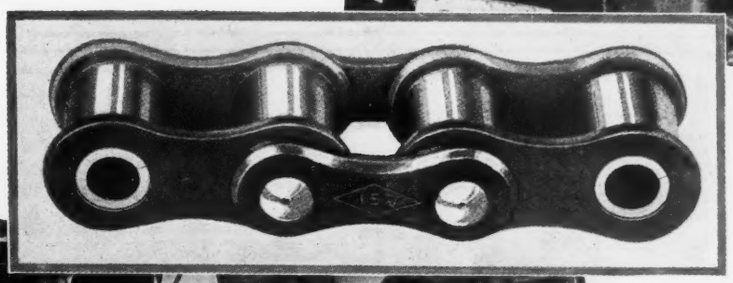
AUTOMATIC BAIRD MACHINE CO. BRIDGEPORT, CONN. MACHINERY

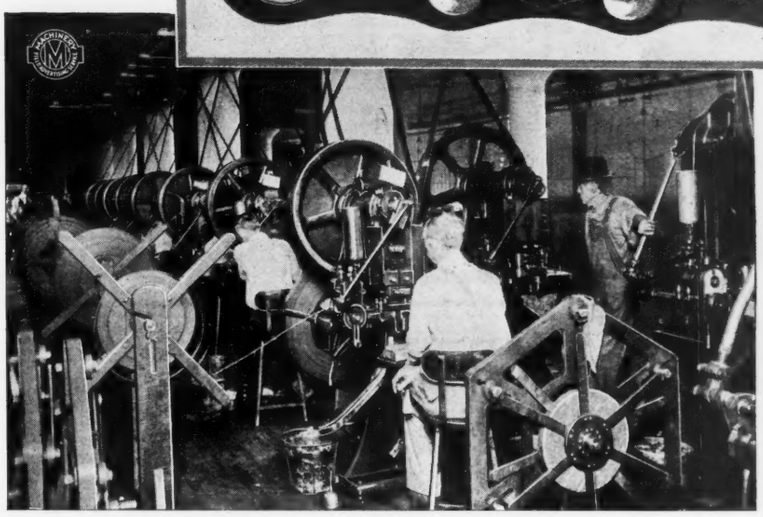
**PRESSES**—Foot and power.
**WIRE FORMING MACHINES**—Standard or special.
**TUMBLERS**—All kinds.
**BALL BURNISHING EQUIPMENT.**

**BAIRD MACHINE CO.**
**BRIDGEPORT, CONN.**

# BLISS PRESSES







## Important Links in Link Production

THERE are 35 Bliss Presses in the plant of the Diamond Chain & Manufacturing Company, Indianapolis, Ind. Some have been in service more than 18 years.

The two photographs herewith show the manufacture of large and small links for Diamond Chains. Automatic feed is used to secure maximum production. Reels of ribbon stock are used for the smaller sizes.

Bliss Presses are universally chosen because of their adaptability. Use of simple attachments makes their range almost endless. They are extremely rigid, assuring maximum life to the dies.

Put your special problems up to Bliss engineers.

BLISS 1857

## E. W. BLISS COMPANY

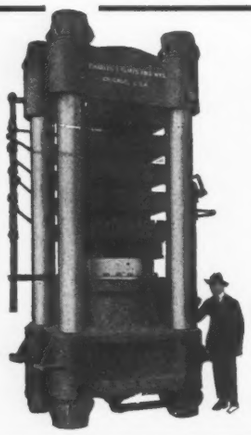
**Main Office and Works: BROOKLYN, N. Y., U. S. A.**

CHICAGO OFFICE Peoples' Gas Bldg. DETROIT OFFICE Dime Bank Bldg. CLEVELAND OFFICE Union Bank Bldg.

LONDON, S.E., ENG., Pocock St., Blackfrairs Rd. PARIS, FRANCE, 100 Blvd. Victor Hugo, St. Ouen

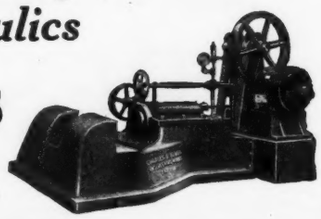
BLISS 1919

No. 59



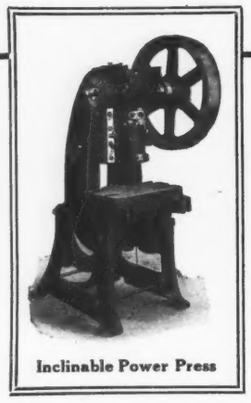
# ELMES-CHICAGO

*More than Half a Century of Successful Hydraulics*



CHARLES F. ELMES ENGINEERING WORKS
222 N. MORGAN STREET
CHICAGO, ILL. U. S. A.

Geared Punching Press



Inclinable Power Press

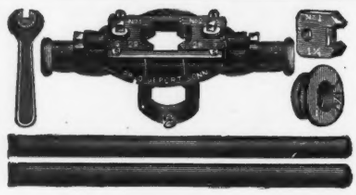
**For Accurate, Economical Press Work**

## Niagara Power Presses

are designed to handle all classes of press work from simple single stampings to heavy work requiring several dies.

Equipped with pin jaw or friction clutch as desired; with stroke, die space, etc., to meet requirements. Weight 250 to 100,000 lbs. Sizes up to 10′ between housings. Catalogue?

**NIAGARA MACHINE AND TOOL WORKS**
BUFFALO NEW YORK, U. S. A.



## Genuine Armstrong Stocks and Dies

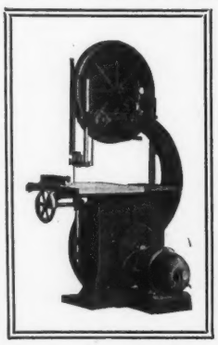
**Some of the advantages of Genuine ARMSTRONG Stocks and Dies:**
Can be adjusted to the variations in the size of fittings.
Results are accomplished with less work and time.
Can be sharpened without drawing the temper.
The dies are interchangeable in the stocks.

***Have you a Set in Your Kit?***

Our Catalog tells the rest of this interesting story, send for it **today.**

**THE ARMSTRONG MFG. CO.**
**297 Knowlton Street** **Bridgeport, Conn.**

## Crescent Wood Working Machinery



is always sold with the understanding that the customer must be satisfied. These are the machines you want to know about. Ask today for our free catalog of band saws, jointers, saw tables, planers, planers and matchers, disk grinders, swing saws, post borers, shapers, variety wood worker, hollow chisel mortiser, universal wood workers, table cut off saw.

**The Crescent Machine Co.**
**56 Main St.** **LEETONIA, OHIO**

Nos. 1, 2 and 5

## Hercules Shears and Rod Cutters

**In Six Sizes**

Are cost reducing tools—for instance, the heavy expense entailed by the present abnormal wage demand is offset by the fact that these tools can be worked with unskilled labor. Look your plant over, and you will be surprised to find the many departments that can use a machine of this kind in the Tool and Stock Room, Machine and Blacksmith Shops, Cutting Off Job and Foundry to cut core rods.

No. 0 cuts 1/16″ flats and under.
No. 1 cuts 3/16″ flats and under.
No. 2 and 3 cuts 1/4″ flats and under.
No. 4 and 5 cuts 5/16″ flats and under.

No. 0 cuts rods 1/8″, 3/16″, 1/4″ and under.
No. 1 cuts rods 1/4″, 3/8″, 1/2″ and under.
No. 2 cuts rods 3/8″, 1/2″, 5/8″ and under.
No. 5 cuts rods 1/2″, 5/8″, 3/4″ and under.

Plain Shears 3 and 4

***Send for Shear Catalog***

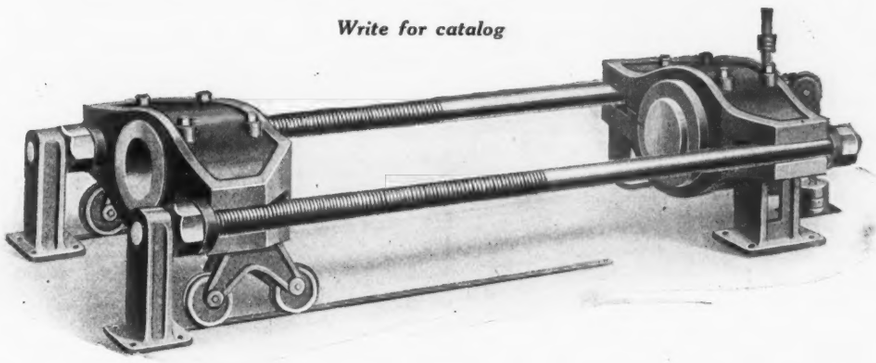
**Manufactured and For Sale by** **W. M. & C. F. TUCKER,** **HARTFORD, CONN., U. S. A.**

# Watson-Stillman
# HYDRAULIC MACHINERY

**This 1000-Ton Horizontal Forcing Press was Designed to Force Journals into Sugar Rolls, and On Account Of Its Open Construction Is Adaptable to Other Heavy Forcing, Assembling, Etc.**

We build hydraulic presses for every purpose where hydraulic pressure is a possibility—for briquetting, baling, die forming, forcing, extruding, etc. We are prepared to furnish complete hydraulic plant from pipe to press, including accumulators, pumps, intensifiers, air compressors, valves, fittings, etc.

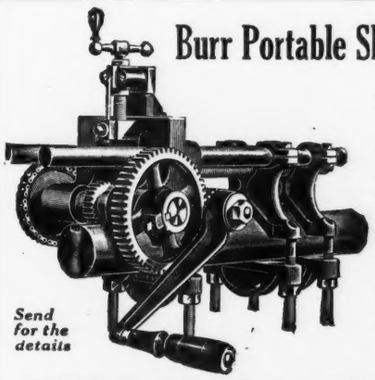
*Write for catalog*



**THE WATSON-STILLMAN CO., 192 Fulton St., New York**
**Chicago: McCormick Building**

408

## Burr Portable Shaft Keyseater



*Send for the details*

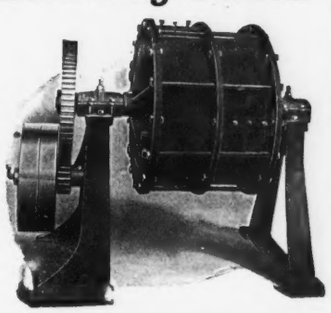
A convenient device that cuts accurate keyways up to 5" in diameter and 12" long without resetting. Use it with the shafting in position—a single breakdown need not tie up the works. Invaluable in emergencies — useful always.

**JOHN T. BURR & SON,** 429 Kent Avenue BROOKLYN, N.Y.

*For Well-finished Work and a Clean Shop*

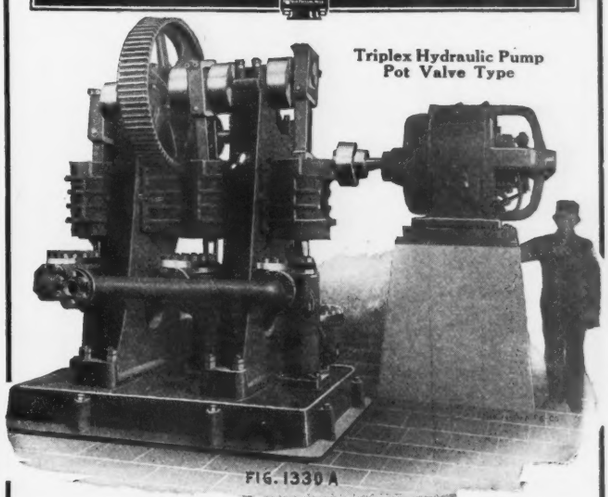
## Use Abbott Burnishing Barrels

Convenient, efficient, economical. Let us burnish some samples for you. All sizes burnishing balls in stock for immediate shipment.



**THE ABBOTT BALL COMPANY**
Elmwood, Hartford, Conn.

## HYDRAULIC MACHINERY



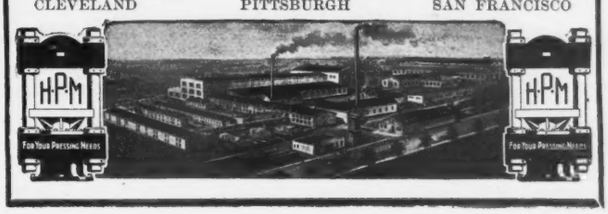
Triplex Hydraulic Pump
Pot Valve Type

FIG. 1330 A

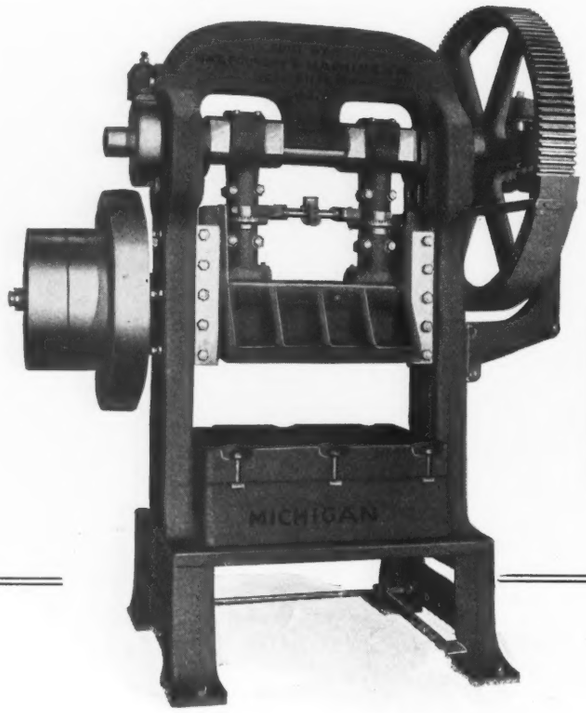
## H-P-M HYDRAULIC PUMPS

Hydraulic pressure troubles are minimized by the use of H-P-M high grade Pumps, Valves and Fittings. World wide reputation for reliability. Hydraulic Equipment for every high pressure purpose.

**THE HYDRAULIC PRESS MFG. CO.**
*Engineer-Builders of Hydraulic Machinery exclusively*
**MOUNT GILEAD, OHIO, U.S.A.**
NEW YORK CITY · SUFFERN, N. Y. · DETROIT
CLEVELAND · PITTSBURGH · SAN FRANCISCO



*A Complete Line of Dependable Presses*




No. 84-D Straight Side Double Crank Michigan Press. Built in 20 sizes, plain and geared.

# MICHIGAN PRESSES

Michigan Presses are sturdy, durable machines, designed and built to obtain maximum production on the respective operations for which the various types are intended.

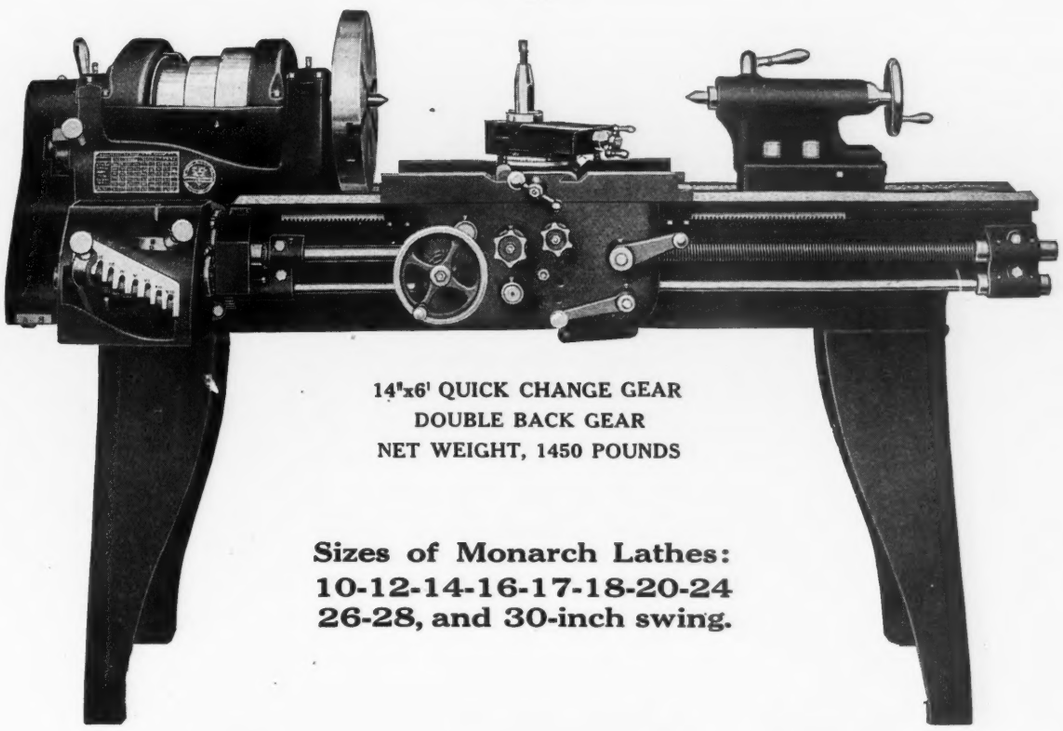
Every facility for convenience in operation has been provided; nothing has been overlooked that might further insure the safety of operators.

*Let us know your requirements and we'll send descriptive literature.*

## NATIONAL FOUNDRY & MACHINE COMPANY, Inc.

YPSILANTI MICHIGAN, U. S. A.

Monarch Machine Tool Company Sidney, Ohio.



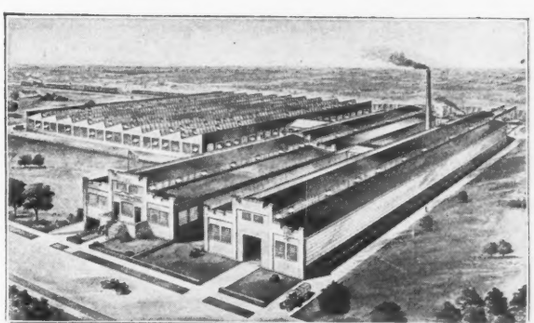
14"x6' QUICK CHANGE GEAR
DOUBLE BACK GEAR
NET WEIGHT, 1450 POUNDS

**Sizes of Monarch Lathes:**
**10-12-14-16-17-18-20-24**
**26-28, and 30-inch swing.**

*Things to Remember About*

# MONARCH LATHES

1. Accuracy second to none.
2. Workmanship, of course, is right.
3. Design in accord with latest practice.
4. Materials the very best obtainable on account quantity buying.
5. Annual production about 3000 lathes.
6. Every Monarch lathe backed by a real guarantee to give satisfaction to the purchaser.
7. Used and endorsed by the most exacting lathe buyers all over the world.
8. Sold and guaranteed by a leading machinery dealer in almost all industrial centers.
9. Built by lathe specialists who do nothing else.
10. Prices are always moderate.



THE PLANT BEHIND MONARCH LATHES

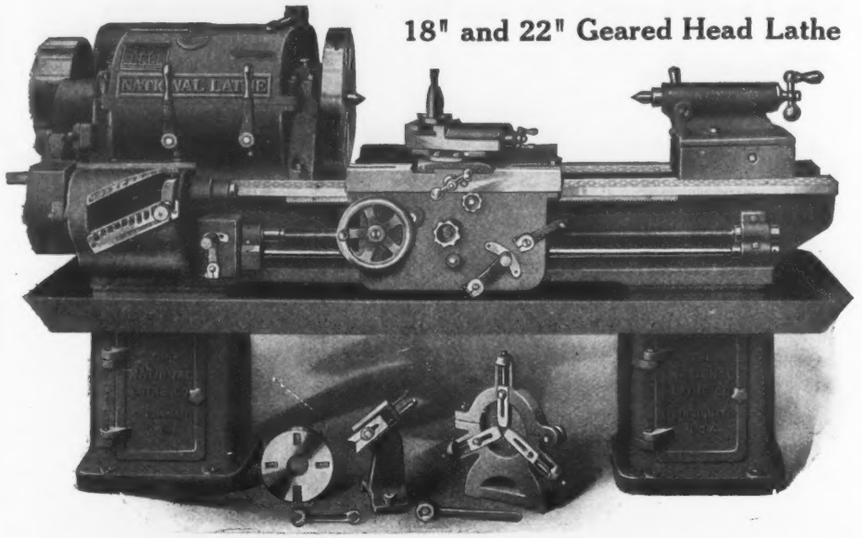
***Send for Catalog or consult the Monarch dealer nearest you***

## THE MONARCH MACHINE TOOL CO.

### SIDNEY, OHIO, U. S. A.

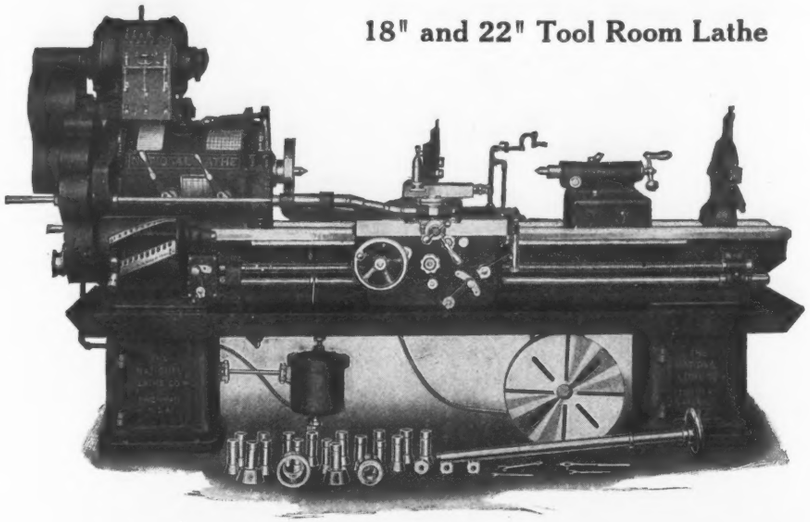
DEALERS: Lynd-Farquhar Co., Boston, Mass. Brownell Machinery Co., Providence, R. I. Purinton & Smith Co., Hartford, Conn. Kemp Machinery Co., Baltimore, Md. Vandyck Churchill Co., New York City, N. Y. Morris Mchy. Co., Newark, N. J. Syracuse Supply Co., Syracuse, Buffalo and Rochester, N. Y. Simmons Mch. Co., Albany, N. Y. Monarch Machinery Co., Philadelphia, Pa. J. S. Miller Machinery Co., Pittsburgh, Pa. W. M. Pattison Supply Co., Cleveland, O. Coughlin Machinery & Supply Co., Toledo, O. Patterson Tool & Supply Co., Dayton, O. Osborne & Sexton Machinery Co., Columbus, O. Vonnegut Machinery Co., Indianapolis, Ind. Greensboro Supply Co., Greensboro, N. C. John P. Dale Mchy. Co., Nashville. Oliver H. Van Horn Co., New Orleans, La. Charles A. Strelinger Co., Detroit, Mich. McMullen Mchy. Co., Grand Rapids, Mich. Federal Mchy. Sales Co., Chicago, Ill. Badger Packard Mchy. Co., Milwaukee, Wis. Northern Machinery Co., Minneapolis, Minn. Colcord Wright Machinery & Supply Co., St. Louis, Mo. English Tool & Supply Co., Kansas City, Mo. Sunderland Machinery & Supply Co., Omaha, Neb. Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo. Salt Lake Hdwe. Co., Salt Lake City, Utah. General Machinery Co., Spokane. Hallidie Machinery Co., Seattle. Eccles & Smith Co., Portland, San Francisco and Los Angeles. Seegar-Walraven & Co., Atlanta, Ga. FOREIGN DEALERS: Chas. Churchill Co., Ltd., England. Honore Demoor, Belgium. Mestre and Blatge, Brazil. Pascual Teja, Mexico. W. Blake Patterson, Special Representative, Italy and Switzerland.

18" and 22" Geared Head Lathe



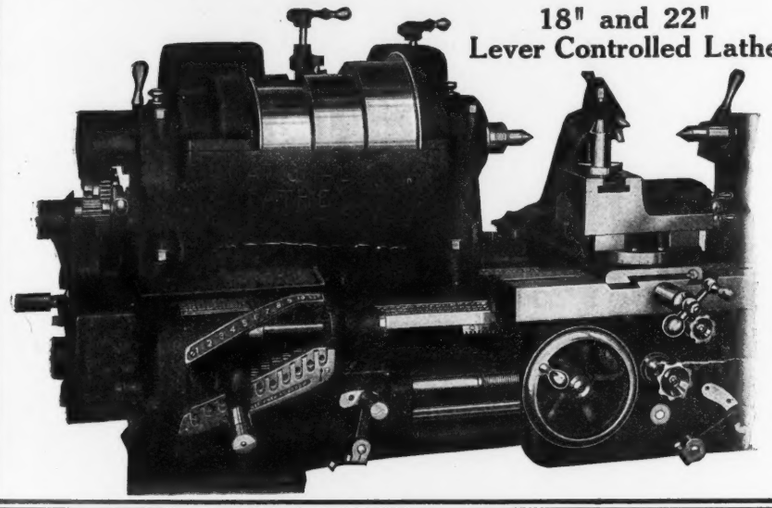
Another "Good One" is our National 24" Heavy Duty Lathe

18" and 22" Tool Room Lathe



# FOUR GOOD ONES—NONE BETTER

18" and 22" Lever Controlled Lathe

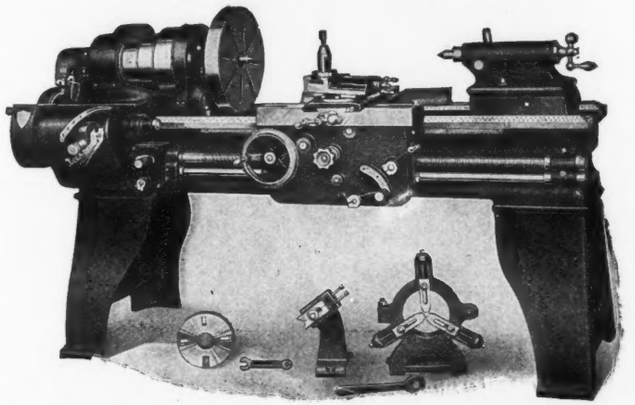


**The National Lathe Co.**

**Cincinnati Ohio**

***Write us for full information***

17" and 20" Cone Pulley Lathe



# MULLINER

## The "COMMON SENSE" LATHE

*"Unretouched" Letters from our Customers No. 5*

**THE CLEVELAND BRASS MFG. CO.**
**HIGH GRADE BRASS GOODS**

Cleveland, O., Nov. 24, 1917.

MULLINER-ENLUND TOOL CO.,
Syracuse, N. Y.

Gentlemen:—

We recently purchased a 14" 6' compound rest taper attachment, quick change gear, your make, Mulliner engine lathe for our tool room.

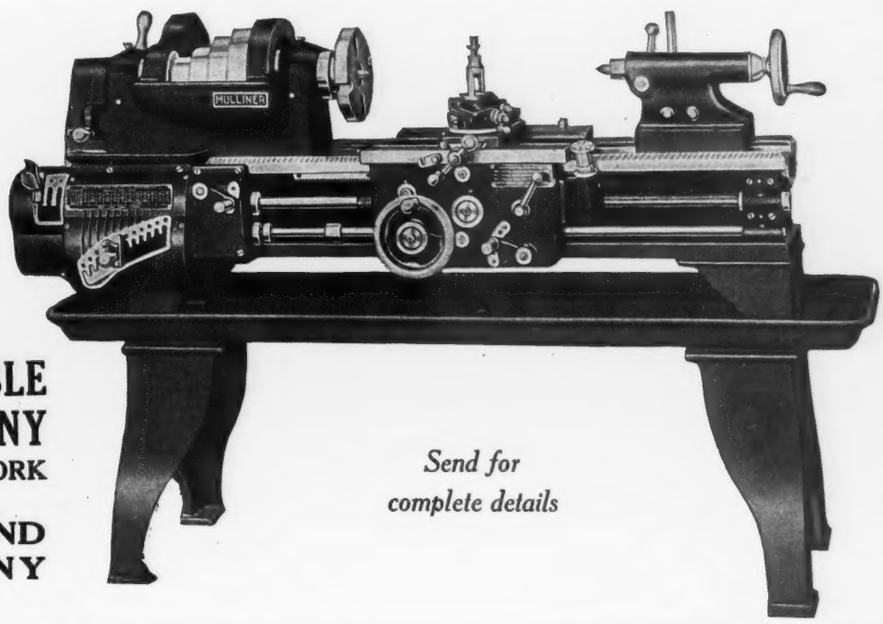
We can truthfully say of this lathe that it has given us entire satisfaction. The foreman of our tool room reports that he can do very accurate work on this lathe. In fact, he is better pleased with it than he has been with the well-known make of lathe that we have been using for some years.

When we are in the market for any engine lathes of this type, we shall certainly give you an opportunity to figure on our requirements. We are

Yours very truly,
THE CLEVELAND BRASS MFG. CO.
W. H. SMITH,
Secy. & Treas.

WHS:REB

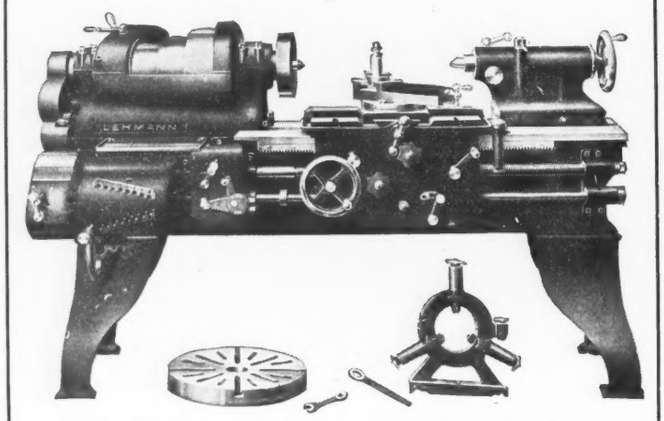
*"Users Attest that the Mulliner's Best"*




**THE PORTER-CABLE MACHINE COMPANY**
SYRACUSE NEW YORK
SUCCESSORS TO
**MULLINER-ENLUND TOOL COMPANY**

*Send for complete details*

# STILL GOING STRONG
## WITH THE DEMAND 100% PLUS



TWO SIZES—16", Swing 18¼" and 18", Swing 20¼"

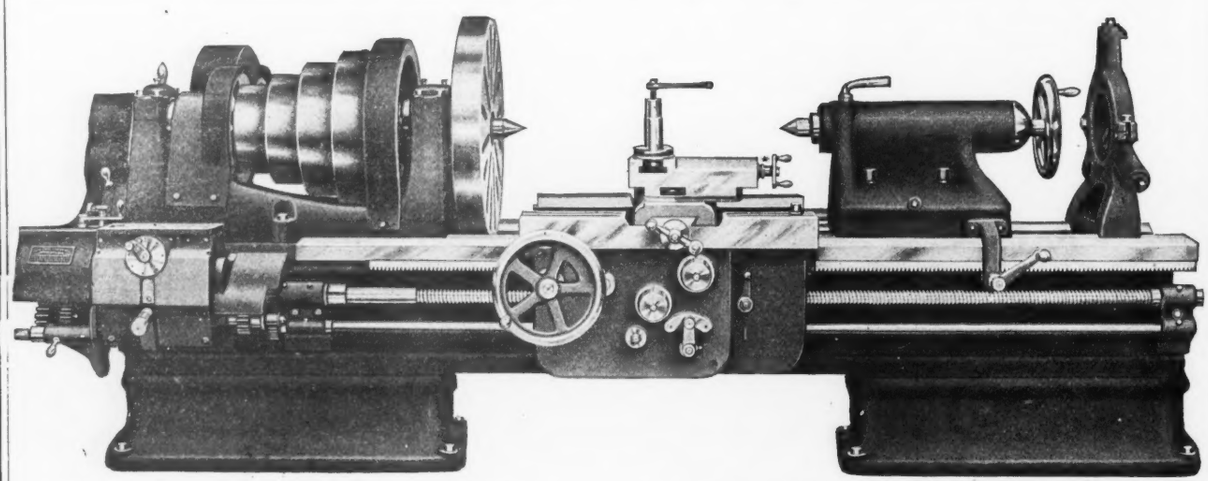
Which certainly proves that "LEHMANN LATHES" have made good, and that the world knows it. Consequently we are still speeding up our output to meet the constantly increasing demand, which their good work has created.

The specifications of this superior lathe will interest you. The design includes all the latest ideas in lathe construction, along with features of our own, which are real improvements.

*Write us today for the facts*

**LEHMANN MACHINE COMPANY,** 514 S. Broadway, **St. Louis, Mo., U.S.A.**

# 30-Inch Instantaneous Change Gear Engine Lathe

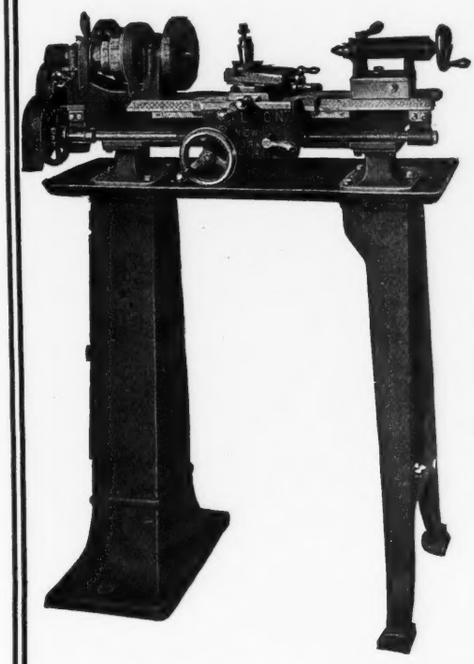


DOUBLE BACK GEARED DOUBLE PLATE APRON

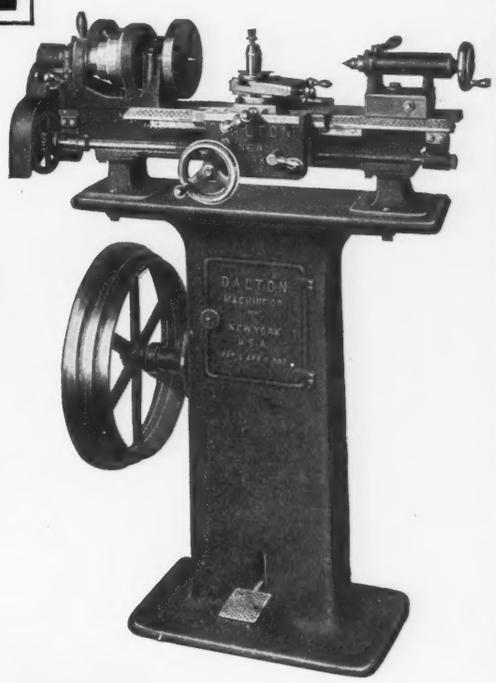
## THE BOYE & EMMES MACHINE TOOL CO.
### ENGINE LATHES

2245-2251 Spring Grove Avenue CINCINNATI, OHIO, U. S. A.

TRADE MARK
"DALTON SIX"
REGISTERED

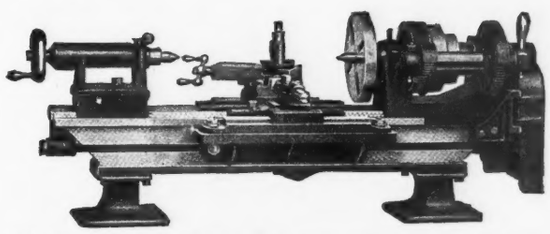


# Three of a Kind



High leg cabinet type.

Pedestal type arranged for Foot Drive.



Standard Model, "B-4" bench type, with taper attachment.

# THE "DALTON SIX"

The cuts show three of the forms in which the "Dalton Six" is offered.

Precision machines, made to do the finest work that can be demanded of an engine lathe, equipped with a large variety of special attachments, with an actual swing of 7¼" and other dimensions proportionally generous. These Dalton six-inch lathes have range, power and convenience that make them unusually valuable for light manufacturing or in the tool room.

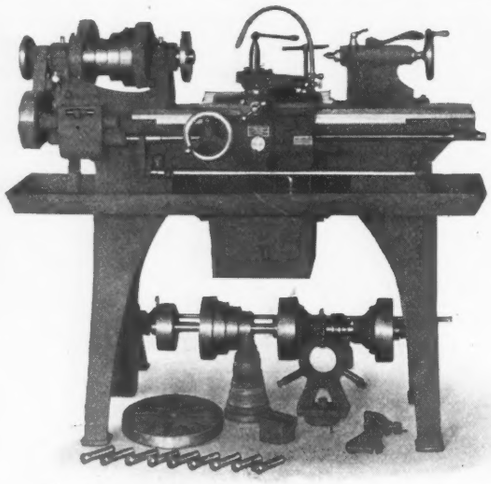
**Drawn-in Attachment, Taper Attachment, Turret Attachment, Internal and External Grinding Attachments, Foot Power Belt and Motor Drive.**

***Send for the Circular***

## DALTON MFG. CORPORATION

**1915 PARK AVENUE** **NEW YORK CITY**

# THE WORCESTER
## 12" TOOL ROOM LATHE



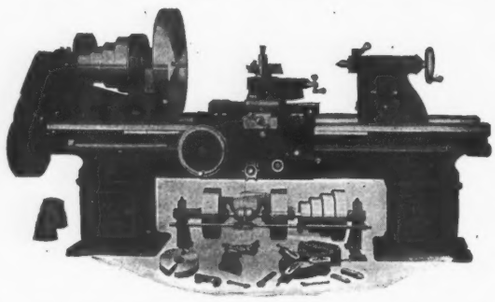
This machine can be furnished with Cone Head—as shown—or with Geared Head for motor drive or single pulley drive. The special equipment for this machine includes taper attachment graduated in degrees, draw-in chucks and collet and a pressed steel oil pan.

*Send for the circular and full description.*

**WORCESTER LATHE COMPANY**

**68 PRESCOTT ST. WORCESTER, MASS.**

# SOUTH BEND LATHE



**South Bend Lathes Have Been on the Market Thirteen Years**

**OVER 20000 IN USE**

Made in six sizes—13″, 15″, 16″, 18″, 21″, and 24″ swing with beds from 4′ to 16′ in length. Made with straight or gap bed. Equipment shown in illustration included.

**REASONABLE IN PRICE**

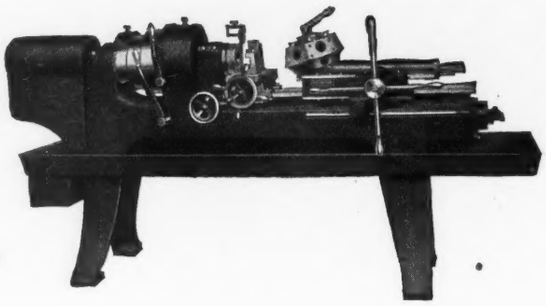
*Dealers in every large city. Send for free Catalog illustrating and describing entire line.*

**South Bend Lathe Works**

**420 E. Madison St. Established 1906 South Bend, Ind.**

THE TILTED TURRET

A CLEAR TRACK TO THE STOCK



ACCURATE *and*
PRODUCTIVE

TURRET LATHES *and*
SCREW MACHINES

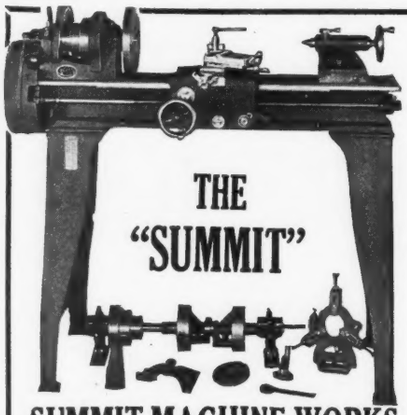
Fifteen years of thoroughly tested service

***Ask the User***

**Send for a Catalog**

WOOD TURRET MACHINE CO.

BRAZIL, INDIANA, U.S.A.




AN accurate machine, made for efficient economical production. The Summit 10" Screw Cutting Engine Lathe cuts threads from 5 to 40 per inch up to 11½".

***Send for circular of specifications***

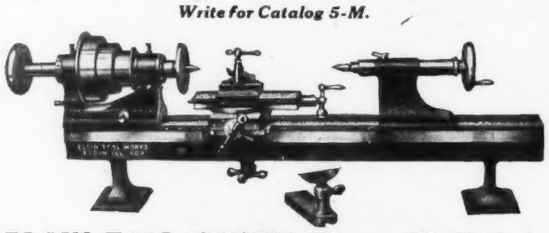
**SUMMIT MACHINE WORKS,** 54 Hermon Street Worcester, Mass.

# Elgin Precision Bench Lathes

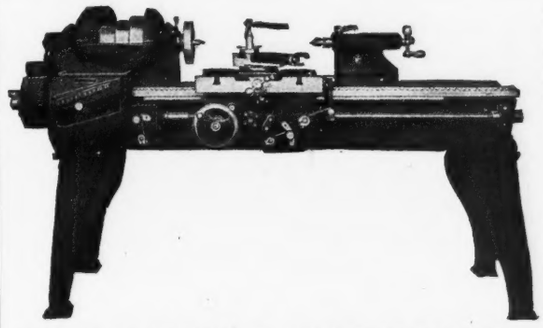
***WE'RE PROUD OF THEM***

We're proud of Elgin Lathes. We know they'll please you because they have "made good" everywhere. They are accurate lathes, have every convenience, are rugged. We'd like to send additional information.

***Write for Catalog 5-M.***



**ELGIN TOOL WORKS, Elgin, Ill. U. S. A.**



## Read Our Specifications

Before going ahead get a copy of our specifications of this 14" engine lathe. It's a

### CARROLL-JAMIESON Screw Cutting Lathe

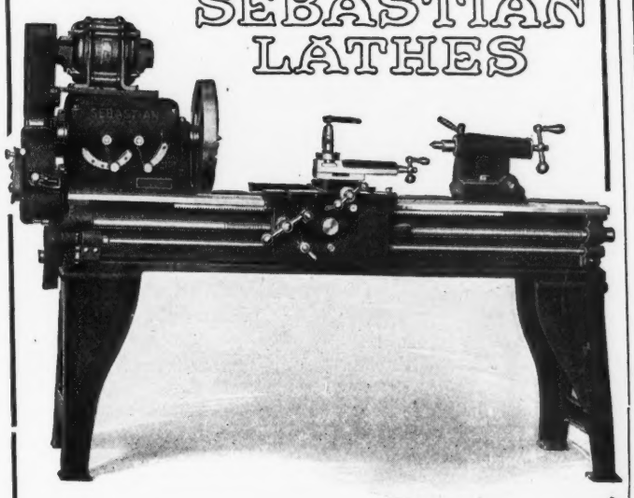
It has double back gears, quick-change gears giving thirty-two changes of feed without removing a gear, nine spindle speeds, 2½" belt drive from three-step cone.

*Drop a line now for a set of specifications.*

**THE CARROLL-JAMIESON MACHINE TOOL CO., 257 Davis St., Batavia, Ohio**

George H. Alexander, Coleshill Street, Birmingham, England, Selling Agents in the British Isles.

## SEBASTIAN LATHES



*10-13-15-inch Swing*

There are many worth-while features about **Sebastian Lathes,** besides the fact that they are reasonably priced. You should know about them. Send for our catalog and tell us for what work you require a lathe.

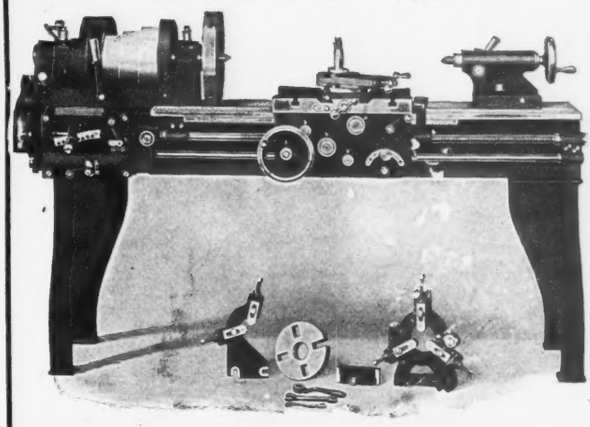
**The Sebastian Lathe Co.**

**154 Culvert Street, Cincinnati, Ohio, U. S. A.**

## Rockford "Economy"

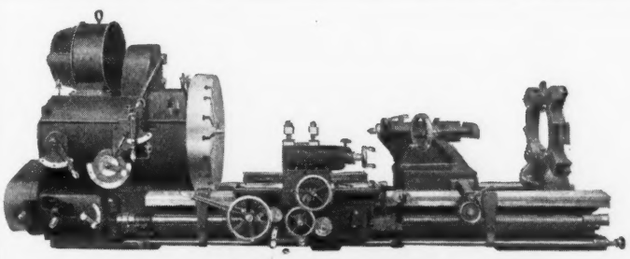
Cut steel gears and other high quality features give this small, heavy duty lathe ample power for economical production to modern manufacturing standards. Distinctive thread chasing device, including chasing dial, and an unusual range of threads adapt it to a wide variety of close limit work.

*Several sizes—Details on request*



**Rockford Lathe & Drill Co.**

ROCKFORD ILLINOIS



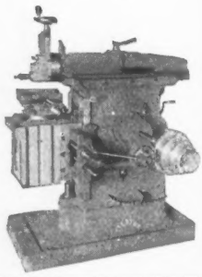
Built in 36" to 72" Swing

**THE HOUSTON, STANWOOD & GAMBLE CO.**

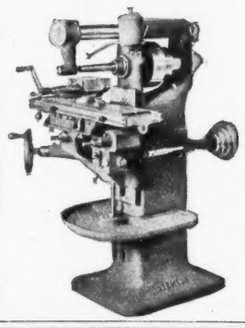
**CINCINNATI, U. S. A.**

# LARGE LATHES

# Steptoe Shapers and Milling Machines



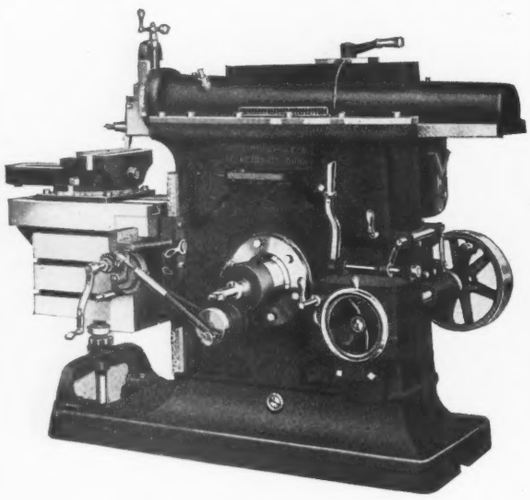
Represent seventy-four years of experience in the manufacture of high-grade machine tools and thousands of our machines are in shops giving daily satisfaction.



**The John Steptoe Company**
BRIGHTON CINCINNATI, OHIO

WE CONFINE OURSELVES TO BUILDING

## Shapers Exclusively



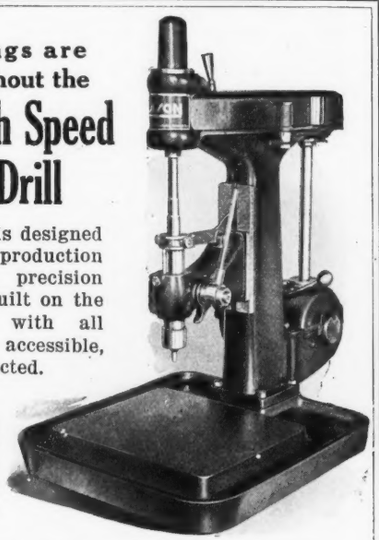
Crank Sizes: 12, 14, 16, 20, 25, 28, and 32 inch
Either Cone Driven or through Speed Box

**Smith & Mills Company**
CINCINNATI OHIO, U. S. A.

Ball Bearings are Used throughout the

## Mason High Speed Bench Drill

This machine is designed for the rapid production of duplicate precision parts and is built on the unit system with all parts readily accessible, but fully protected.

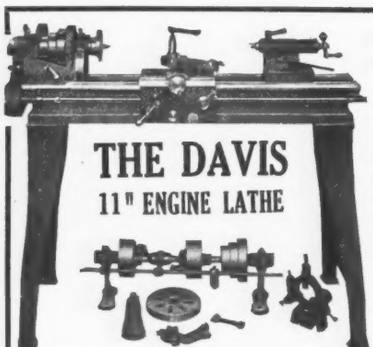


Four Spindle Speed Maximum Feed 6½" Capacity up to ¼" Drills. Full Description on Request.

This machine is well designed and finely finished in every detail.

Changes of speed are made without stopping the machine, back lash is eliminated and a positive depth gage insures accuracy in drilling to a given point.

**Arthur C. Mason, Incorporated**
Second St. and Susquehanna R. R.
HAWTHORNE NEW JERSEY




ELIMINATE THE NON-ESSENTIALS

## Davis Lathes

are accurate, speedy, convenient—extremely simple in construction and operation and especially valuable for tool and experimental shops.

*Send for the specifications*

**C. F. DAVIS MACHINE CO., Inc.**
133 ANDREWS ST. ROCHESTER, N. Y.
Also Manufacturers of Davis Keyseat Cutters

## Kelly Crank Shapers Cover the Field

The smallest, our little 15" Single Geared Machine, has 18" cross traverse of table, 14" vertical and is 16" from ram to top of table. Tool head feeds 6½" and ram stroke is 10 to 50 per minute. Our big 24" Back Geared Shaper weighs 4800 pounds and it takes cuts as heavy as many planers. Kelly Shapers are made 15", 18" and 20" single geared and 16", 20", 24" back geared—all may be equipped for motor drive if desired.

Details in Catalog.

**R. A. KELLY COMPANY, XENIA, OHIO**
BUILDERS OF CRANK SHAPERS EXCLUSIVELY

# THE DAVIS SHAPER

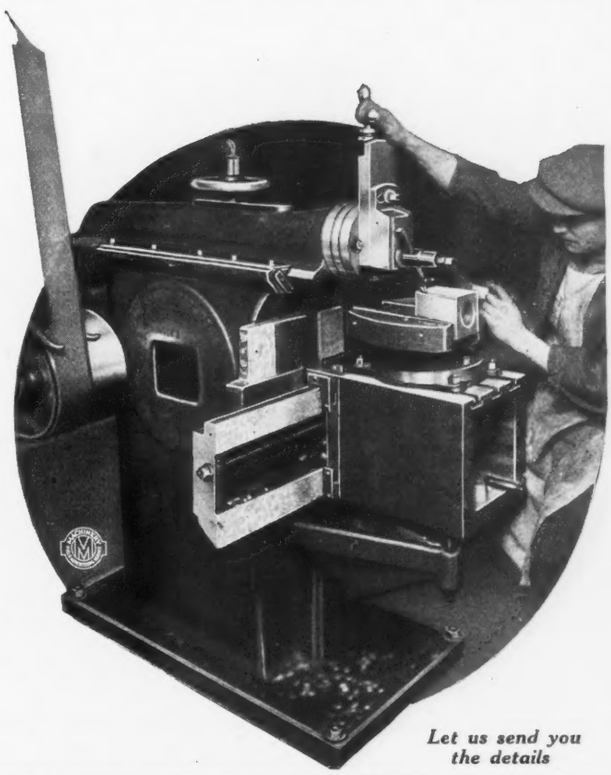
## Where Accuracy is Most Important

The Frank H. Lee Co., Danbury, Conn., builds high class toolroom planers and has a well merited reputation for fine contract work besides.

This class of products necessitates the best equipment—and every machine in the shop is a leader in its line, including the Davis Shaper which is used for every operation to which it can possibly be applied.

Significant?

Well rather! but not surprising to anyone familiar with the distinctive features of this accurate and serviceable machine.

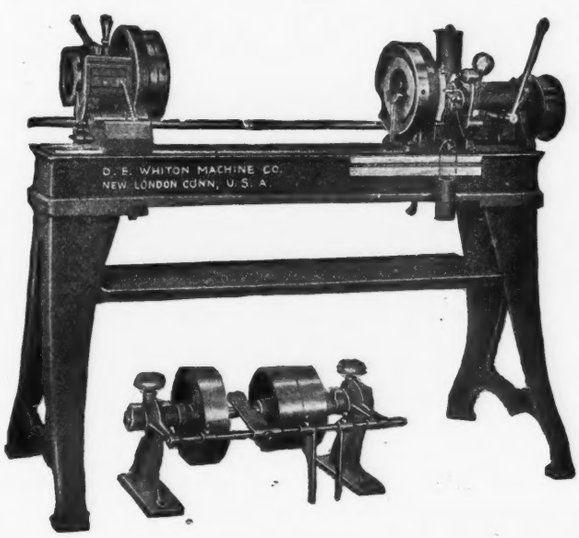


*Let us send you the details*

**DAVIS MACHINE TOOL CO., Inc.**

**ROCHESTER N. Y., U. S. A.**

# THE WHITON
# Revolving Centering Machine




*For Accurately Centering Finished Shafts*

The cut shows new **Revolving Centering Machine**—a large size of the well-known machine of this type. It is heavier throughout and has capacity to center shafts up to 5 inches in diameter.

Constructed same as the smaller machine and embodies all the special features.

Circulars and prices sent upon application.

**The D. E. WHITON MACHINE CO.**

**NEW LONDON, CONNECTICUT, U. S. A.**

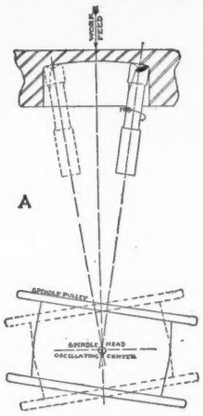
# Superior Slot Milling Machine

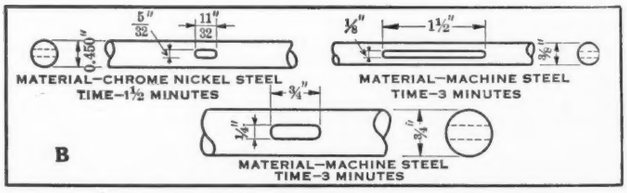
*Ask for further particulars*

## Slots up to 2¼" Long Up to ⅜" Wide

Chips do not bother in milling slots by our method as they do not clog the mill.

The mill swings in an arc ot a circle as it revolves. See sketch "A". See diagram "B" showing slots and time required to mill them.



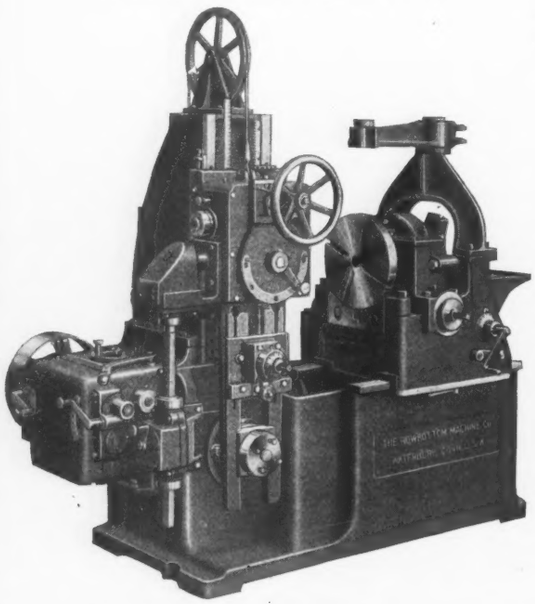

**Superior Machine & Engineering Co.**

**51-53 East Fort St., Detroit, Mich.**

R. T. WINGO C. E. SWEET

# Rowbottom for Cams

Increasing numbers ot new machines depend on accurate cams for satisfactory service.



## Rowbottom Cam Milling Machines

***Cut Cams Economically***

The cutter head bears directly on the roller following the pattern. Accuracy is assured at a production speed impossible to achieve by any other method.

Have you many cams to cut? A "Rowbottom" will be a good investment. Have you few? Let us cut them for you in our Contract Department—*using the same machine.*

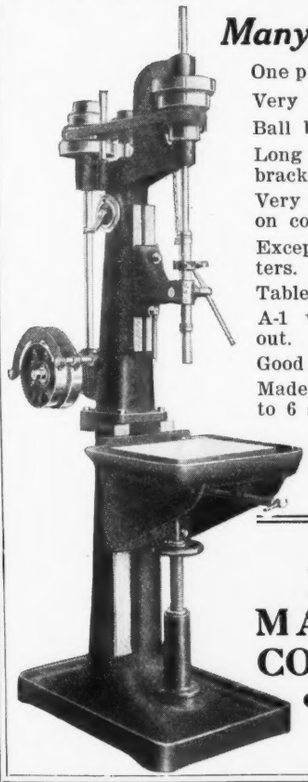
***Write Us for Details***

**THE ROWBOTTOM MACHINE CO.**

**Factory: Waterville, Conn.**

WATERBURY CONN., U. S. A.

# EDLUND SENSITIVE DRILLING MACHINE



*Many Good Features*

One piece frame above base.
Very large cone pulleys.
Ball bearings throughout.
Long bearing for quill bracket—9".
Very long bearing of knee on column.
Exceptionally deep oil gutters.
Table well ribbed.
A-1 workmanship throughout.
Good deliveries.
Made in styles with from 1 to 6 spindles.

*Let us send complete details*

**EDLUND MACHINERY COMPANY, Inc.**
CORTLAND, N. Y.
Box 45

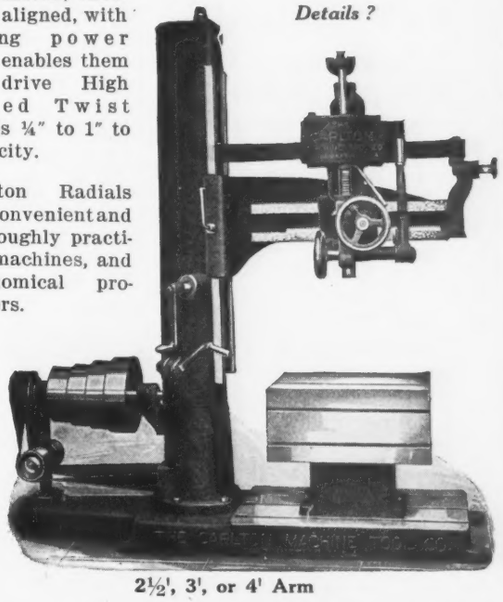
# CARLTON RADIAL DRILLS

**Speedy—Sensitive—Powerful**

Belt driven, carefully aligned, with pulling power that enables them to drive High Speed Twist Drills ¼" to 1" to capacity.

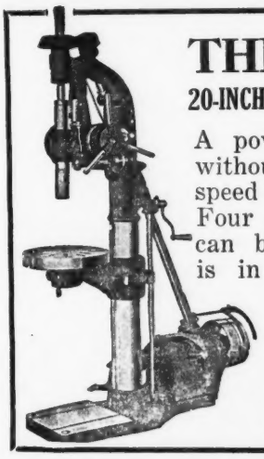
Carlton Radials are convenient and thoroughly practical machines, and economical producers.

*Details ?*



2½', 3', or 4' Arm

**THE CARLTON MACHINE TOOL CO.**
2994 SPRING GROVE AVENUE
CINCINNATI OHIO, U. S. A.



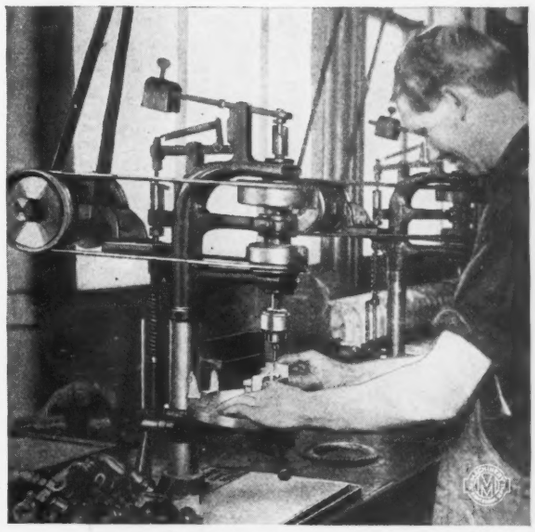
# THE LINDGREN

**20-INCH HIGH SPEED ALL GEARED DRILL**

A powerful machine, 5 speeds without back gear. Bearing in speed box fitted with ring oilers; Four change positive gear feed; can be changed while machine is in operation. Star handle.

*New lubrication features.*
*No leakage of oil.*

**F. W. LINDGREN CO.**
ROCKFORD ILLINOIS, U. S. A.



**Increase Production of Small Parts**

# TUTTLE TAPPERS

The Bench Type No. 2, for foot lever operation, makes output simply a matter of operating skill. Tuttle Tappers tap holes up to ¼"; have an automatic stop that can be set to tap any depth desired.

Send for the circular.

**PARAGON GEAR WORKS**
TAUNTON (Evans Stamping and Plating Co.) MASS.

# INCREASE THE SPEED OF YOUR DRILLING OPERATIONS

A drill of remarkable efficiency; sensitive, easily operated and durable. Of great value in production manufacturing, and for many tool room jobs.

## WINTERHOFF 10½" Bench Drill

has ball thrust bearings adjusted for wear and end play. Motor or belt drive. 0" to ½" capacity. Prompt deliveries.

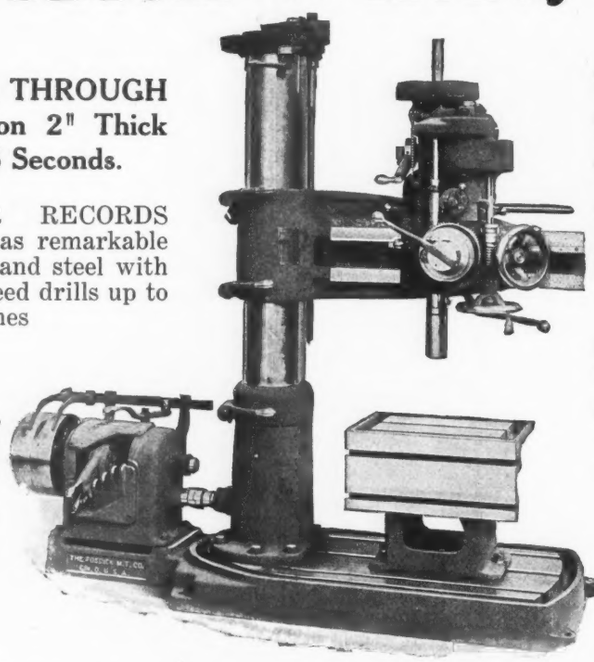
*Speeds 400 to 2400 Guaranteed*

**WINTERHOFF TOOL & MACHINE CO.**
ELKHART INDIANA

# FOSDICK 2 and 2½ Ft. Heavy Duty Radials

**1" Drill THROUGH Cast Iron 2" Thick in 7 4/5 Seconds.**

OTHER RECORDS equally as remarkable in iron and steel with high speed drills up to 2½ inches



***Send for drilling and tapping test sheet***

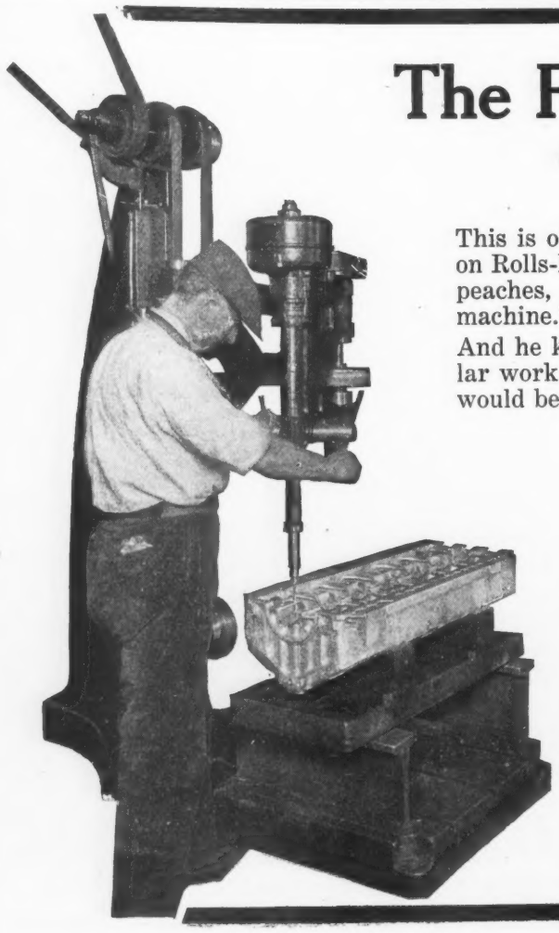
**The INTERCHANGEABLE DRIVE**
**The EXTRAORDINARY POWER**
**The LUBRICATING SYSTEM**
**The HARDENED BEVEL GEARING**
**The BRONZE BUSHINGS**

and many other valuable features will be found in these machines.

**THE FOSDICK MACHINE TOOL COMPANY**

**CINCINNATI OHIO, U. S. A.**

AGENTS: Biggs-Watterson Co., Cleveland, Ohio. Colcord-Wright Mchy. & Supply Co., St. Louis, Mo. Eccles & Smith Co., San Francisco, Cal., Los Angeles, Cal., Portland, Oregon, Fairbanks Co., New York City, N. Y., Hartford, Conn., Albany, N. Y. E. A. Kinsey Co., Cincinnati, Ohio, Indianapolis, Ind. Homer Strong, Rochester and Buffalo. Peninsular Mchy. Co., Detroit, Mich. H. A. Smith Mchy. Co., Syracuse, N. Y. Swind Mchy. Co., Philadelphia, Pa. Somers, Fitler & Todd Co., Pittsburgh, Pa. Stocker-Rumely-Wachs Co., Chicago, Ill., Milwaukee, Wis. Taylor Mchy. Co., Boston, Mass. A. R. Williams Machinery Co., Ltd., Toronto, Ont., Canada. Burton, Griffiths & Co., Ltd., London, England. Fenwick Freres & Co., Paris, France. Wynmalen & Hausmann, Rotterdam, Holland. Rylander & Asplund, Stockholm, Sweden. Wilh. Sonesson & Co., Malmo, Sweden, Copenhagen, Denmark. Roku-Roku Shoten, Tokyo, Japan. R. L. Scrutton & Co., Sydney, Australia.



# The Foreman Says: "They're Peaches"

This is one of a battery of three "Hammonds" which worked on Rolls-Royce airplane engines. The foreman says: "They're peaches, and I think a lot of them. They're certainly *some* machine."

And he knew, for they worked day after day on this particular work where one spoiled hole would scrap a $500 job. You would be equally enthusiastic if you owned one.

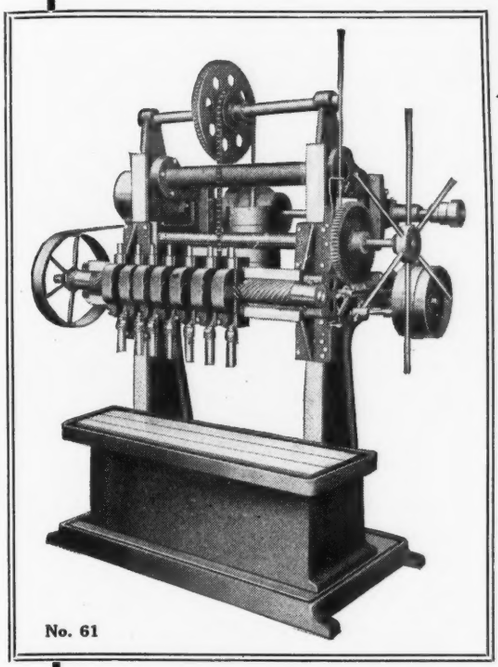
**HAMMOND**
*Sensitive High Speed*
**RADIAL DRILL**

In many plants Hammonds have reduced the cost of light drilling and tapping nearly 50 per cent. They are built in wall type or with column and base, either belt or motor driven.

*Write for bulletin.*

**The Hammond Mfg. Co.**
**Cleveland, Ohio, U. S. A.**

## THE SHORTEST ROUTE TO THE BEST RESULTS



No. 61

# THE "HOLE HOG"

Keen competition and high priced labor are steadily reducing the difference between factory cost and the price paid by the consumer.

That this is well realized by many of the leading manufacturers is evidenced by the close study they are giving to labor saving tools and devices.

Drilling and boring holes one at a time, for instance, is as expensive as it is unnecessary. The "Hole Hog" drills or bores many holes simultaneously. Investigate the "Hole Hog" as applied to *your* work—it will well repay you.

## MOLINE TOOL COMPANY, Moline, Illinois

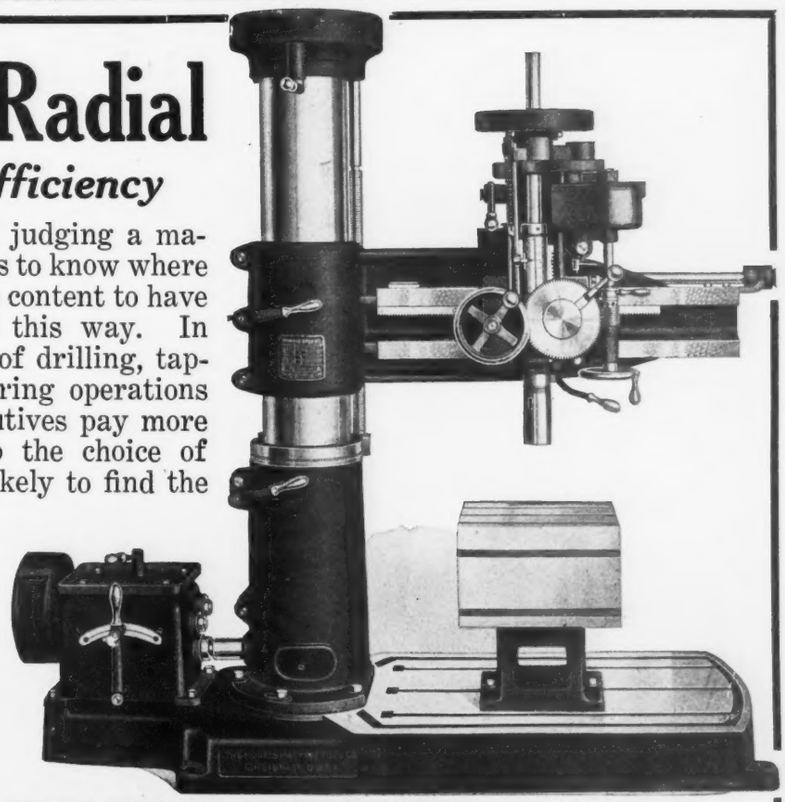
# The Morris Radial

## *The Choice for Efficiency*

One of the best methods of judging a machine tool without seeing it is to know where it is installed. We are quite content to have the Morris Radial judged this way. In plants where a wide range of drilling, tapping, facing and counterboring operations are performed, whose executives pay more than ordinary attention to the choice of equipment; there you are likely to find the Morris Radial.

Even if the full range of this drill is never used, it is still a paying proposition—and it has power in reserve. Have you the facts on the Morris Radial?

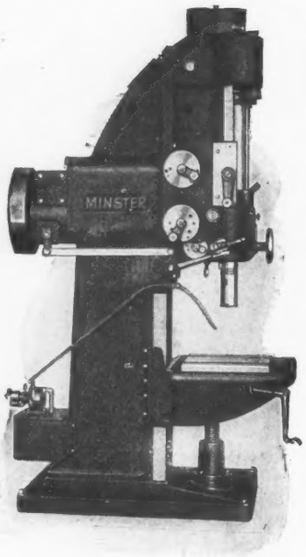
***Morris Radials are made in sizes 2½, 3 and 3½ foot with 12 spindle speeds and 4 and 4½ foot with 18 spindle speeds.***



## THE MORRIS MACHINE TOOL COMPANY, Cincinnati, Ohio

REPRESENTATIVES: Niles-Bement-Pond Company, 111 Broadway, New York City, N. Y., Boston, Mass., Chicago, Ill., Detroit, Mich., Philadelphia, Pa., Pittsburgh, Pa., Plainfield, N. J., St. Louis, Mo. Niles Tool Works Co., Cleveland, O., Hamilton, O. Pratt & Whitney Company, 16 Fremont St., San Francisco, Cal., Birmingham, Ala., Cincinnati, O. The John Bertram & Sons Co., 1002 C. P. R. Building, Toronto, Ontario, Montreal, Quebec, Dundas, Ontario, Winnipeg, Manitoba. The Selson Engineering Co., Ltd., London, England and Turin, Italy. Messrs. Glaenzer & Perreaud, Paris, France. The Taisho Trading Co., Ltd., Tokyo, Japan. Henri Benedictus, Brussels, Belgium.

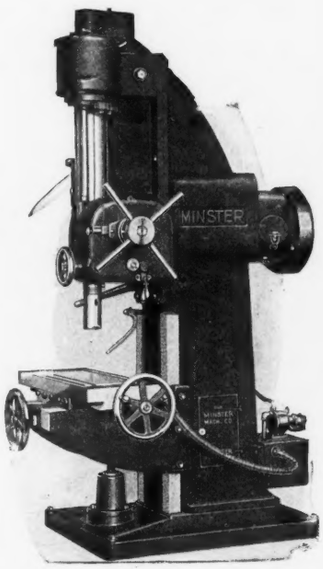
# MINSTER HI-DUTY DRILLS




combine accuracy and speed to produce satisfaction. Exceedingly delicate adjustments, easily made, and a wide range of speeds and feeds mean accurate work—be it fine drilling or heavy boring. Operating conveniences, unusual in machines of this size, make quick action possible and help insure rapid production.

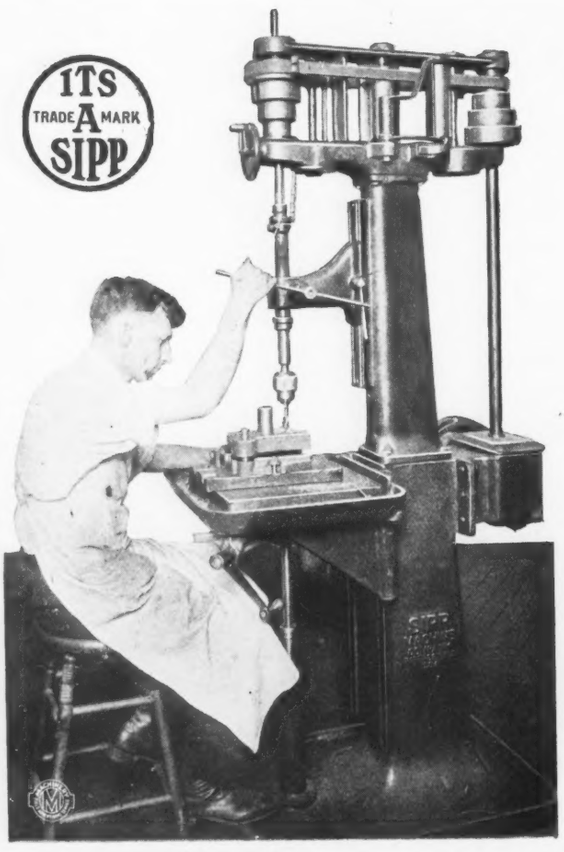
Minster Hi-Duty Drills are wide range machines with heavy pulling power and are made in 3 sizes, capacity 2″, 2½″, and 3¼″ drills.

*Circular?*




## THE MINSTER MACHINE CO., Minster, Ohio

AGENTS: Machine Tool Engineering Co., 149 Broadway, New York; Monarch Mchy. Co., Philadelphia, Pa.; Syracuse Supply Co., Syracuse, N. Y., Buffalo, N. Y., Rochester, N. Y.; J. S. Miller Mchy. Co., Pittsburgh, Pa.; E. A. Kinsey Co., Indianapolis, Ind., Cincinnati, O., Cleveland Tool & Supply Co., Cleveland, O.; W. J. Baird Mchy. Co., Detroit, Mich.; McMullen Mchy. Co., Grand Rapids, Mich.; Federal Machinery Sales Co., Chicago, Ill., Milwaukee, Wis.; Colcord-Wright Mchy. & Supply Co., St. Louis, Mo.; Fred Ward & Son, San Francisco, Cal.; Herberts Machinery & Supply Co., Los Angeles, Cal.; Zimmerman-Wells-Brown Co., Portland, Oregon; Wilcken-Schenck Co., Seattle, Wash.; Manufacturers Selling Agency, Birmingham, Ala.; Williams & Wilson, Ltd., Montreal, Quebec, Can.; Pedro Merline, Buenos Aires, Argentine; Quinones Hardware Corp., Havana, Cuba; Coats Machine Tool Co., Ltd., London, England; Henri Benedictus, Brussels, Belgium.

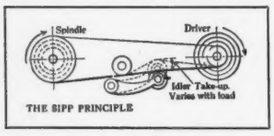



# SIPP DRILLING MACHINE

## *A Toolroom Favorite*

The Sipp quick change belt feature is best appreciated in the toolroom. It is less work to change speed on the Sipp than it is to change tools. The handle above the workman's head is simply turned until the belt jumps to the correct step.

The Specialty Products Co., Newark, N. J., in whose plant this photograph was taken, is mighty well pleased with the service the Sipp has given during the past three and a half years. All kinds of die and tool work have been performed on this busy machine.

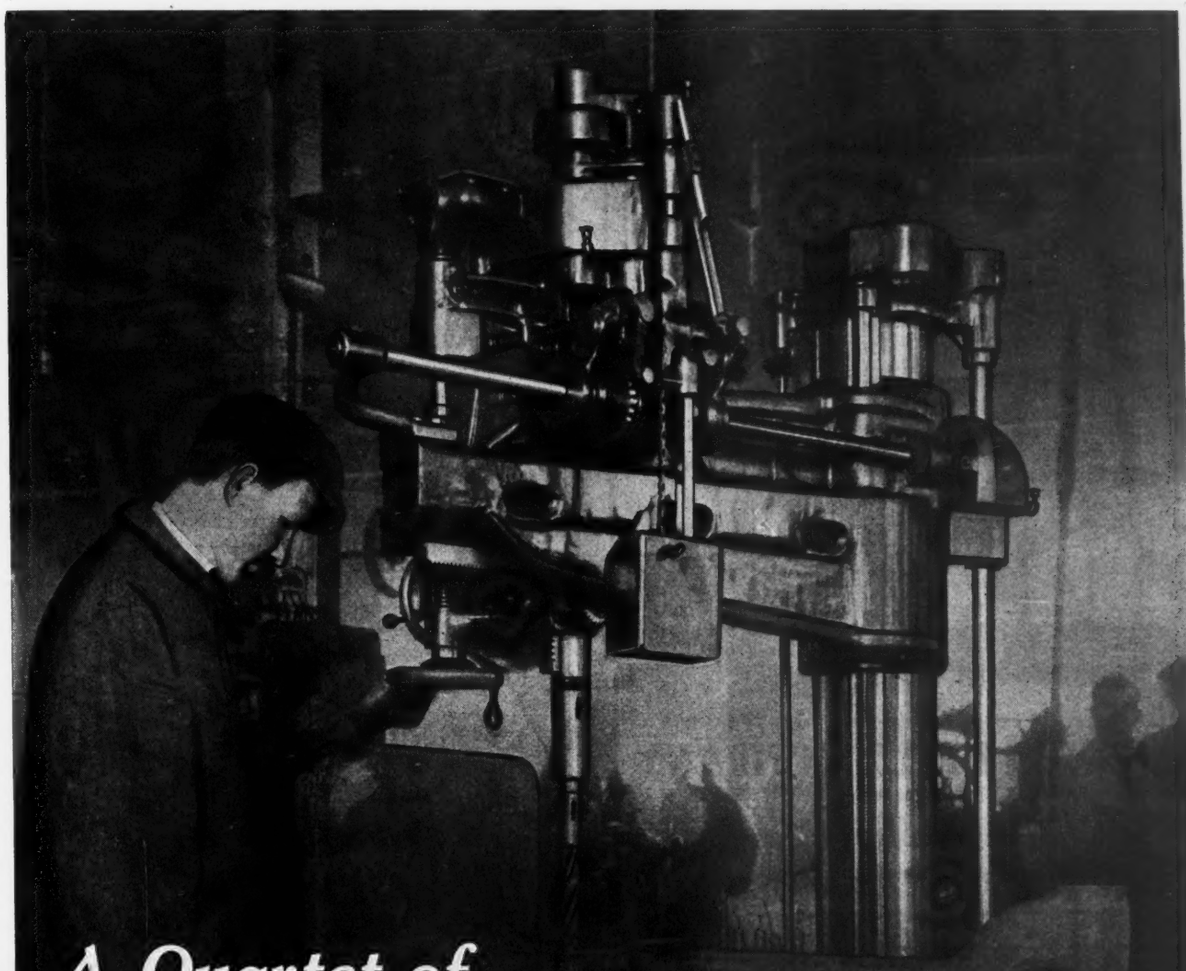


THE SIPP PRINCIPLE

***Let us tell you about the many advantages of the Sipp Drilling Machine.***

## THE SIPP MACHINE CO.

**PATERSON NEW JERSEY**

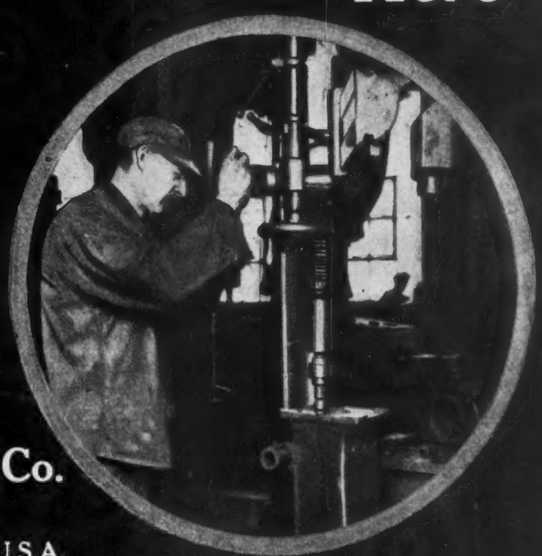


*A Quartet of*

# MUELLER RADIALS

*Here*

One machine in service for more than three years may mean anything short of inefficiency; but when a second, third and fourth of the same type are added, there is but one interpretation—*i.e.*, that their owner has found no better value in their class. Therefore, this picture is more convincing than a volume of description. It shows one Mueller Radial drilling a surface grinder frame, another performing a spot facing operation, with two more in the background—and *the performances of each one sold the next in line.*



*Details?*

**The Mueller Machine Tool Co.**

RADIAL DRILLS AND LATHES

CINCINNATI *Established 1902* OHIO, U.S.A.

# SELF-OILING DRILLS ARE TIME CUTTERS

They hold the secret of cheap production costs.

Our SELF-OILING ALL GEARED line offers you unparalleled efficiency, which includes maximum output.

All gears fully enclosed; all bearings are continuously oiled automatically.

Eight changes each of geared speeds and geared feeds. No cone belts.

The 24" Self-Oiler here shown is equally efficient in tool room and manufacturing departments. Accurate, exceptionally strong, rigid and powerful. Handles high-speed twist drills from ½" to 1¾" at suitable speeds and feeds.

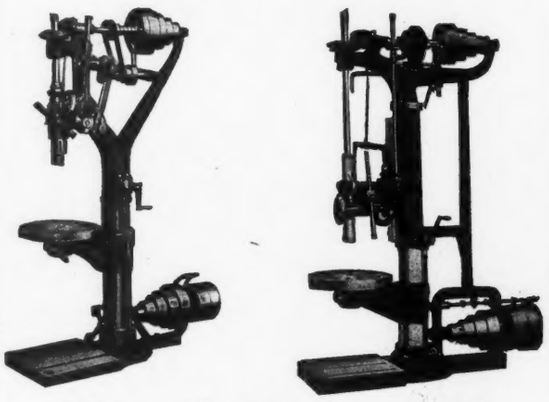
*Catalog "M" gives full details. Write for copy.*

## BARNES DRILL COMPANY

814 Chestnut St. (Incorporated 1907) ROCKFORD, ILL.

Agents for Great Britain: Burton, Griffiths & Co., Ltd., London, E. C. France: R. S. Stokvis & Fils, Paris. Japan: Roku-Roku Shoten, Tokio. Italy: Alfred Herbert, Ltd., Milan. Spain: American Machinery Syndicate, Hudson Terminal Bldg., New York, Barcelona, Madrid, Seville, Bilbao, Santander. New South Wales: R. L. Scrutton & Co., Sydney. Belgium: G. & F. Limbourg Freres, Brussels.

# SILVER



## 20- and 25-Inch Drills

Are simple to operate—substantially built, designed for accuracy as well as speed—very reasonably priced—can be depended on to finish the job. They will solve your drilling problems.

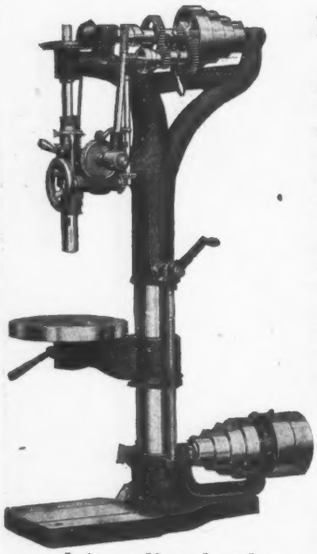
## The Silver Mfg. Co.

385 Broadway, Salem, Ohio

PROMPT DELIVERIES

DROP A CARD FOR CATALOG

# SIBLEY
## Drilling Machines



### 20" SWING

SPECIFICATIONS

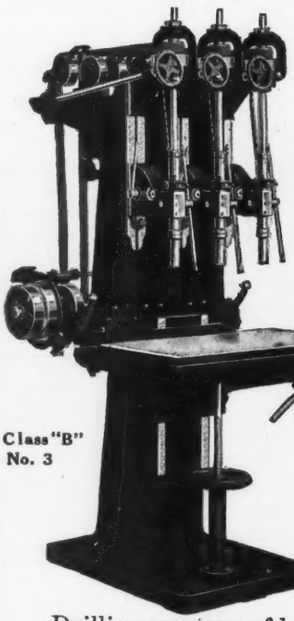
Height 72".
Maximum distance spindle to base 40½".
Maximum distance spindle to table 24".
Feed of spindle 8".
Ratio of bevel gears 1:2.
Ratio of back gears 1:4.
Size of drive pulley 9¼" x 3".
Eight spindle speeds 18 to 276 R. P. M.
Weight, net, 690 lbs.
Weight, boxed, 900 lbs.
Code word—CHILD.

## We Make Drills Only

A complete line of stationary, sliding and traveling head; sensitive and Hi-Speed from 16" to 30" swing, inclusive. Write for Catalogue.

## SIBLEY MACHINE COMPANY

8 Tutt St. South Bend, Ind., U. S. A.



Class "B" No. 3

# Drilling Machines

Henry & Wright Drilling Machines are doing

## More Drilling Than All the Armies in the World

Drilling millions of holes ¾" and under in every conceivable kind of war munitions. They are preferred because of their many advantages.

## THE HENRY & WRIGHT MFG. CO.

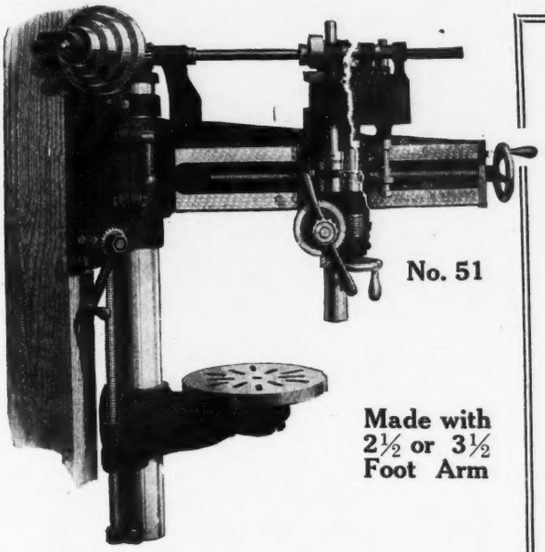
HARTFORD, CONN.

OVER-SEAS REPRESENTATIVE

ALMACOA ALLIED MACHINERY COMPANY OF AMERICA 51 CHAMBERS ST. NEW YORK, U.S.A. ALMACOA

PARIS TURIN ZURICH BARCELONA

# THE CANEDY-OTTO WALL TYPE RADIAL
# A MACHINE EVERYONE CAN AFFORD



No. 51

Made with 2½ or 3½ Foot Arm

*Details and Prices on Request*

No shop is completely equipped without a radial drill; but a big, floor type machine sometimes takes too long to pay for itself, so some owners hesitate over making the investment. While they are making up their minds, others install

**The Canedy-Otto Wall Type Radial**

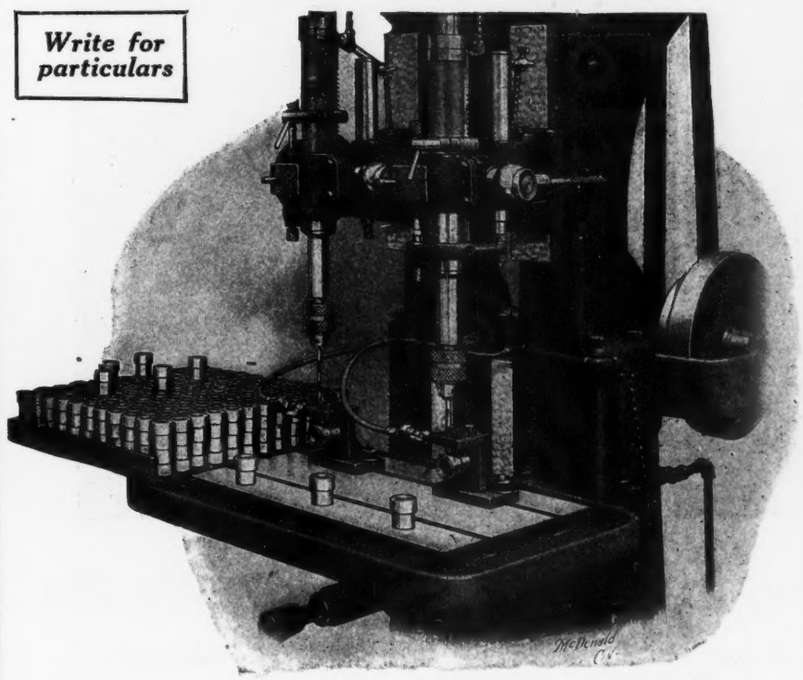
which pays its way almost from the start and is so handy that they soon wonder how they ever did without it.

Garages, bridge, boiler, machine and blacksmith shops find this machine particularly convenient. Quick return lever, automatic cut-off, self-feed and other features adapt it to a wide range of work.

***Carried in Stock by Leading Jobbers and Machinery Dealers Everywhere.***

## CANEDY-OTTO MFG. CO., Chicago Heights, Ill.

*Write for particulars*



# Automatic Drilling

**Do you drill duplicate pieces in large quantities?**
If so, use the

*Avey*

## Automatic

The down feed and return are full automatic.

Stop collars and trip fingers regulate length of stroke.

No idle movement necessary.

Set-up adjustments simple and easy.

## ALL THE OPERATOR DOES IS UNLOAD AND LOAD THE JIGS

The drill withdraws sufficiently to clear the work and allow time to reload. The depth and size of hole being drilled govern number of spindles operator can handle.

## THE CINCINNATI PULLEY MACHINERY CO., CINCINNATI, OHIO

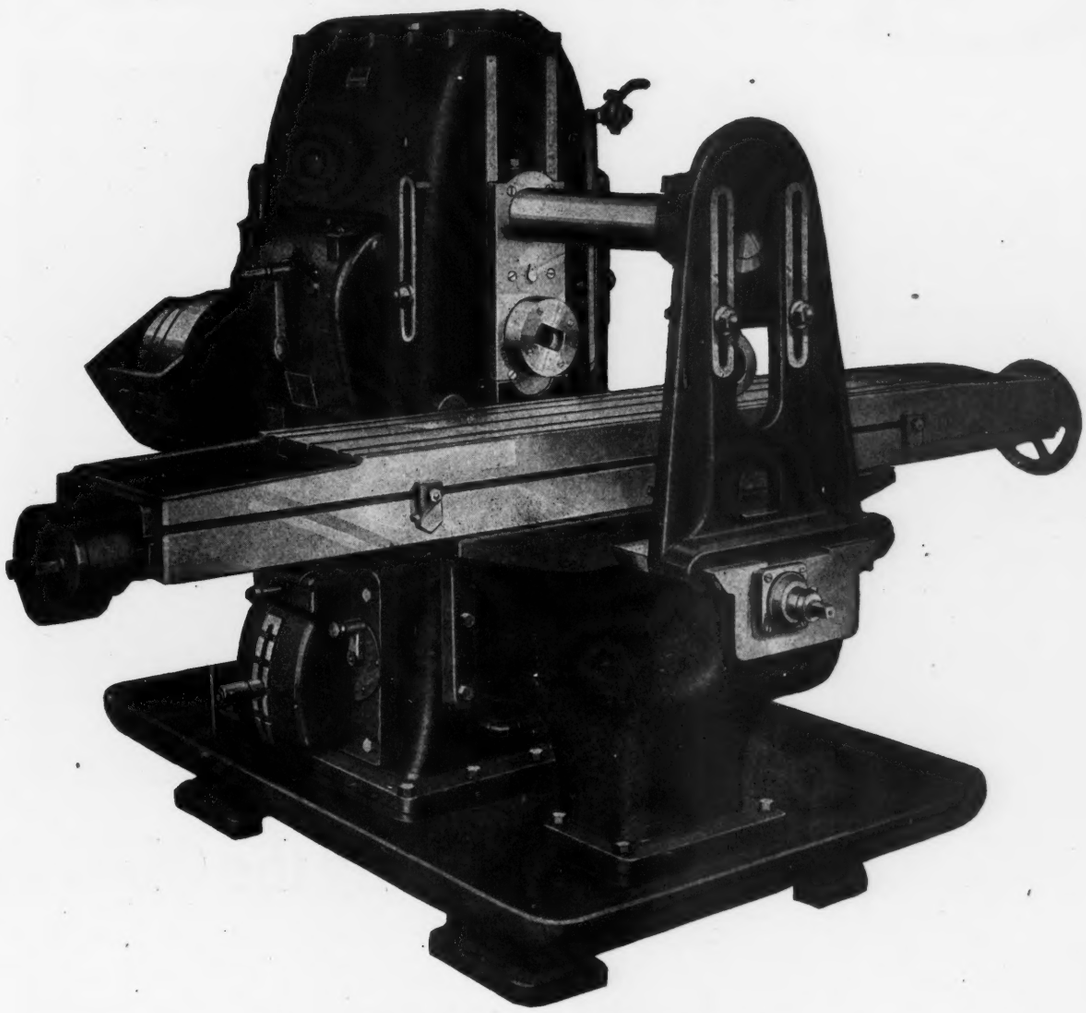
# Part of a line of nineteen Baker Drills

This customer, The Willys-Overland Co., has line after line of them. Can you afford to overlook them on your work? Drilling, boring, tapping, facing, turning, all are within the province of these powerful Baker Vertical Drilling and Boring Machines.

*Get a Baker, start your line! Are you ready?*
*Let's Go! Our engineers will cooperate with you.*

# BAKER BROTHERS, TOLEDO, OHIO

# Heavy Plain Milling Machine



**NATIONAL TRANSIT No. 6**

Designed and intended primarily for manufacturing work, and combines certain features of the Lincoln type and the knee type of milling machine, giving greater general stability, more permanent alignment, increased capacity for a given weight, longer life under heavy cuts and slower depreciation.

***A well-designed and strongly built machine***

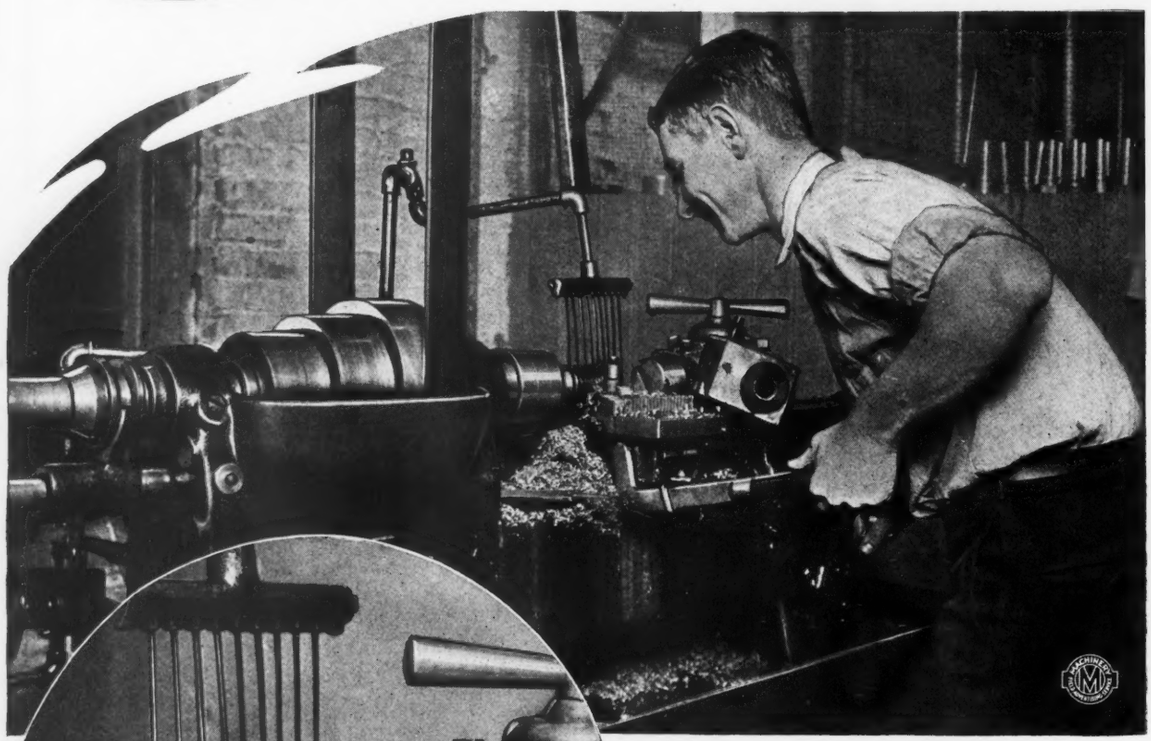
## MANNING, MAXWELL & MOORE, Inc.

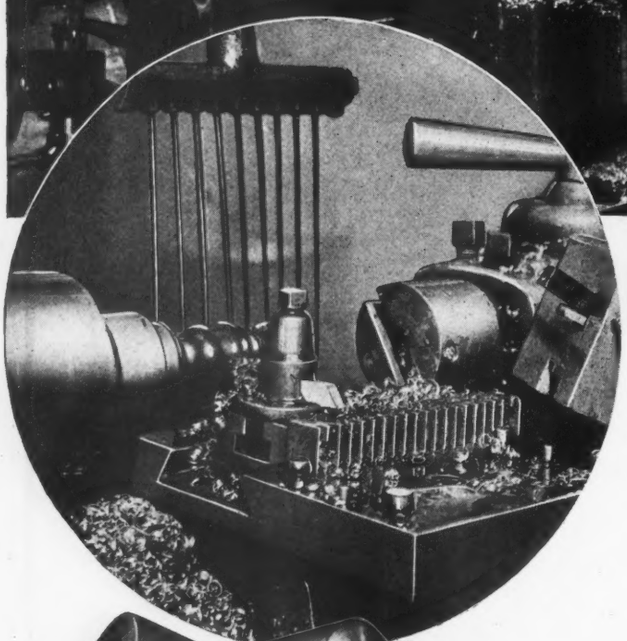
**119 West Fortieth Street** **NEW YORK**

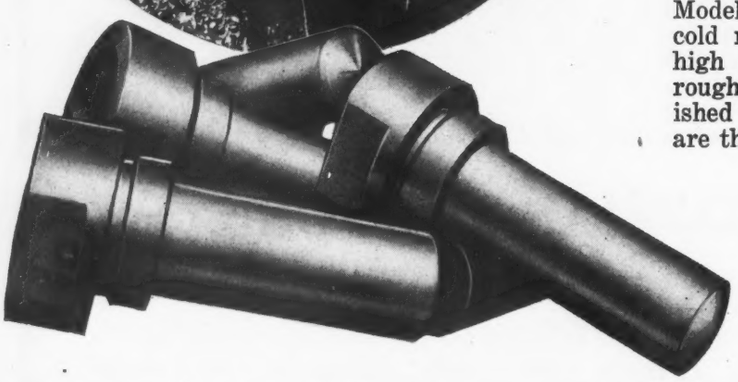
**BRANCHES:**

CHICAGO PHILADELPHIA BOSTON ST. LOUIS PITTSBURGH CLEVELAND NEW HAVEN
CINCINNATI BUFFALO DETROIT MILWAUKEE SAN FRANCISCO SEATTLE, WASH.
MEXICO CITY, MEXICO YOKOHAMA, JAPAN HONG KONG, CHINA

# GARVIN







## Holding the Objective

Urgency of war work gained for many machines unhoped for prominence. Holding the objective, however, often proves difficult. Garvin Machines made a lot of new friends recently. They will maintain these friends, because Garvin Machines built during the war embodied the same high standards as those previously constructed. Photo shows a Garvin Screw Machine in the plant of the B. A. B. Model & Mfg. Co., New York City, machining cold rolled steel dummy boosters (for filling high explosive shells). Parts are chucked, rough and finish turned on taper and form finished on end at the rate of ten per hour. There are three Garvin Machines in this plant.

**"When a GARVIN you install —you've got the best of all"**

*Visitors are always welcome in the Garvin plant. When you are in New York make a worth while call. Meanwhile, we'll be glad to receive your request for details.*

**THE GARVIN MACHINE COMPANY**

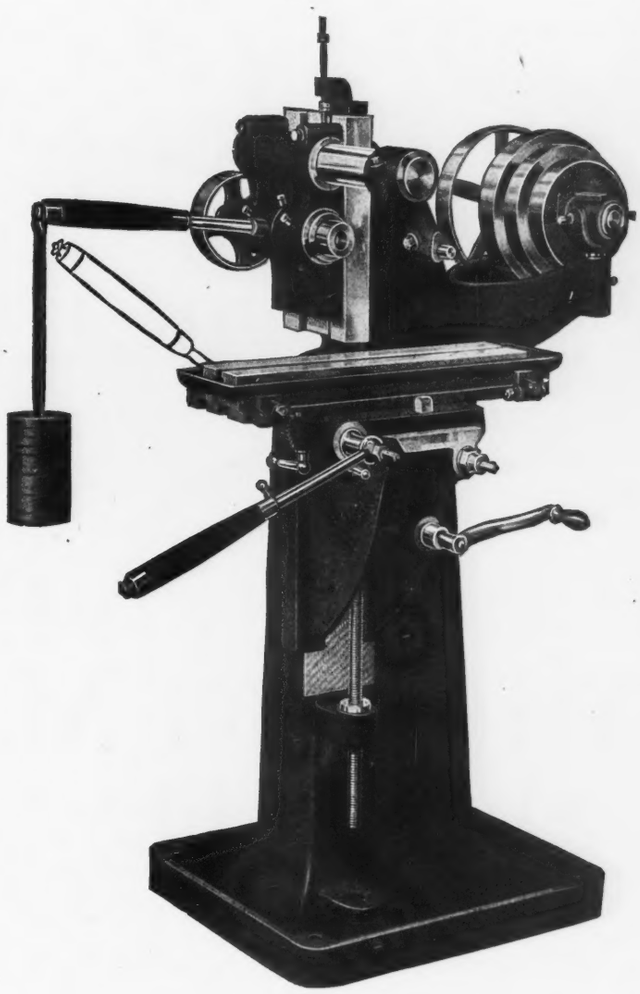
**SPRING AND VARICK STREETS** *50 YEARS IN NEW YORK CITY*

# "WHITNEY"
## HAND MILLING MACHINE

### THOUSANDS IN USE

### Now That Peace Is At Hand

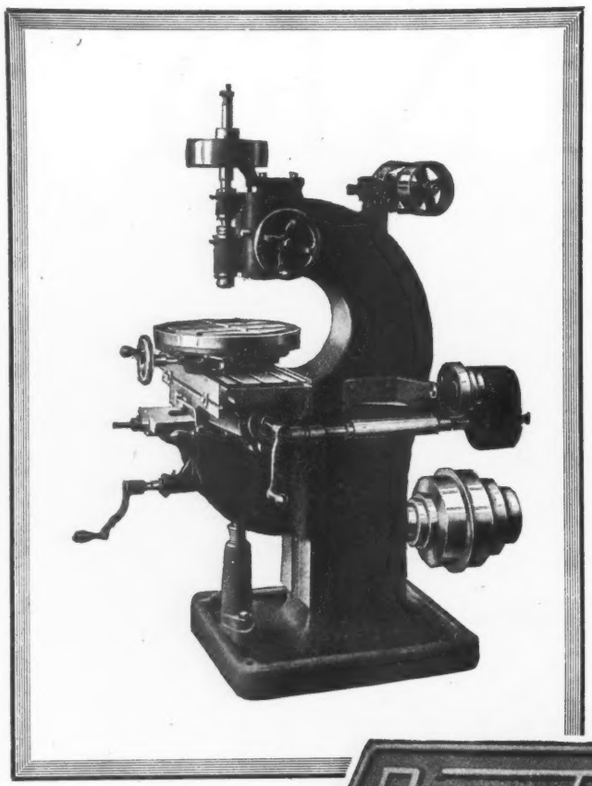
the experience you have had in working up a high production on war material is going to show you many places where you can greatly increase your regular output over the easy going methods of the pre-war period. You are, therefore, certain to need more "Whitney" Hand Millers. Remember that no other design equals it for rapid, accurate, and economical production. Write us now.



***PROMPT DELIVERIES***

## THE WHITNEY MFG. COMPANY
HARTFORD, CONNECTICUT

CHAINS :: KEYS AND CUTTERS :: HAND MILLING MACHINES



*An Unusually Free Running Machine*

BRISTOL

# BRISTOL VERTICAL MILLING MACHINE

The Bristol 10″ x 28″ Vertical Milling Machine is provided with ball bearings wherever their employment will add to the machine's freedom of movement. This not only assures an unusually free running machine, but effects no small saving in the consumption of power.

This machine is admirably adapted for manufacturing because of its strength; it can handle a wide range of work accurately and economically. The vertical position of the spindle is particularly advantageous in the milling of large dies and all circular and segmental work.

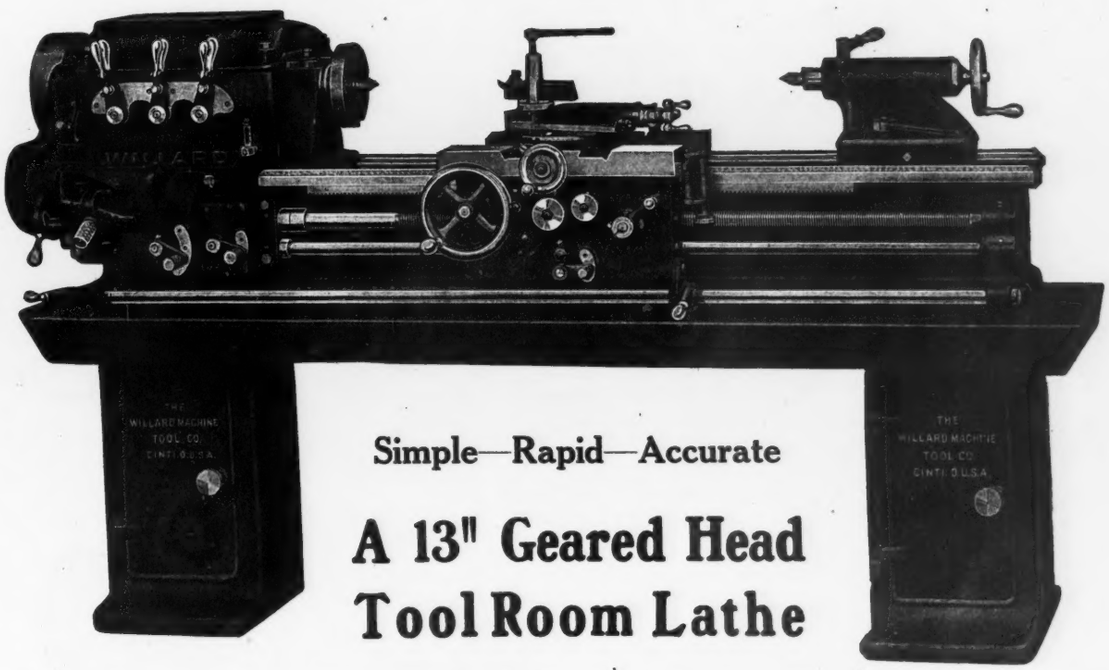
*There are many other points we'd like to tell you about. Write today*

## Bristol Machine Tool Company

BRISTOL SUCCESSORS TO C. G. CARRIGUS MACHINE CO. CONN., U. S. A.

# WILLARD

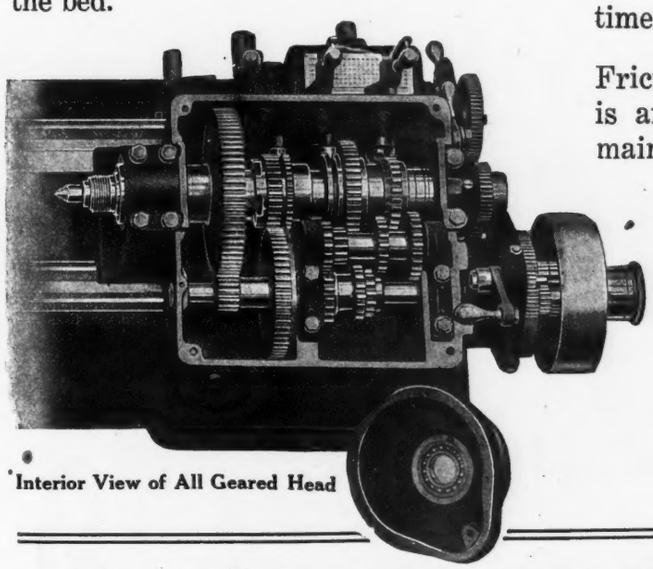
## MATTMAN—BRATTEN



**Simple—Rapid—Accurate**

## A 13" Geared Head Tool Room Lathe

Power and simplicity are outstanding features of this High Power Tool Room Lathe. Headstock is full box section type, well ribbed and completely self-contained, with 21½" bearing on the bed.



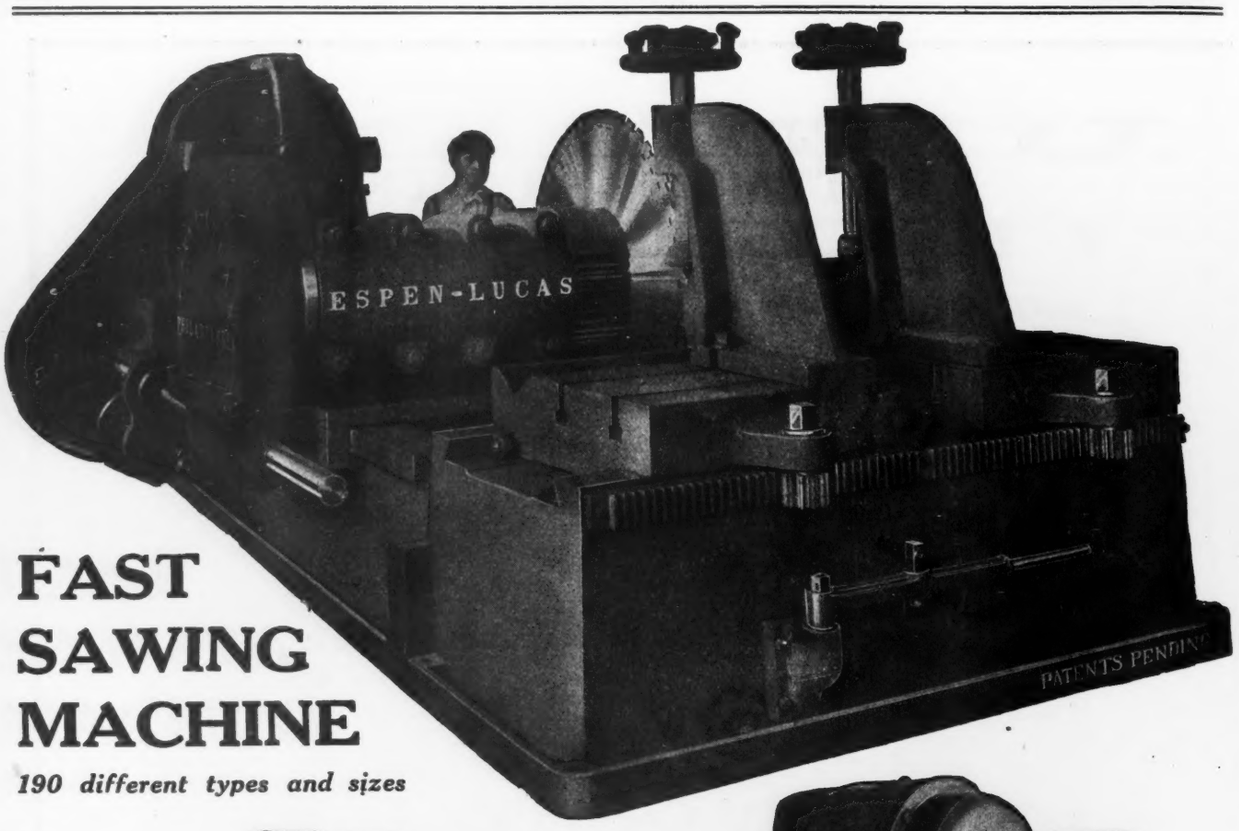
Interior View of All Geared Head

A glance at the interior view shows that the speed change gears—which are of chrome nickel steel and run in oil—are so arranged that it is impossible to throw in two different speeds at one time.

Friction pulley, with brake and reverse, is an independent unit bolted to the main headstock and transmits power through three gears to the intermediate shaft, thence by two sliding gears to the sleeve of the spindle. This provides six direct speeds in all when the clutch is thrown in and six more are available through the back gears. Complete description furnished on request.

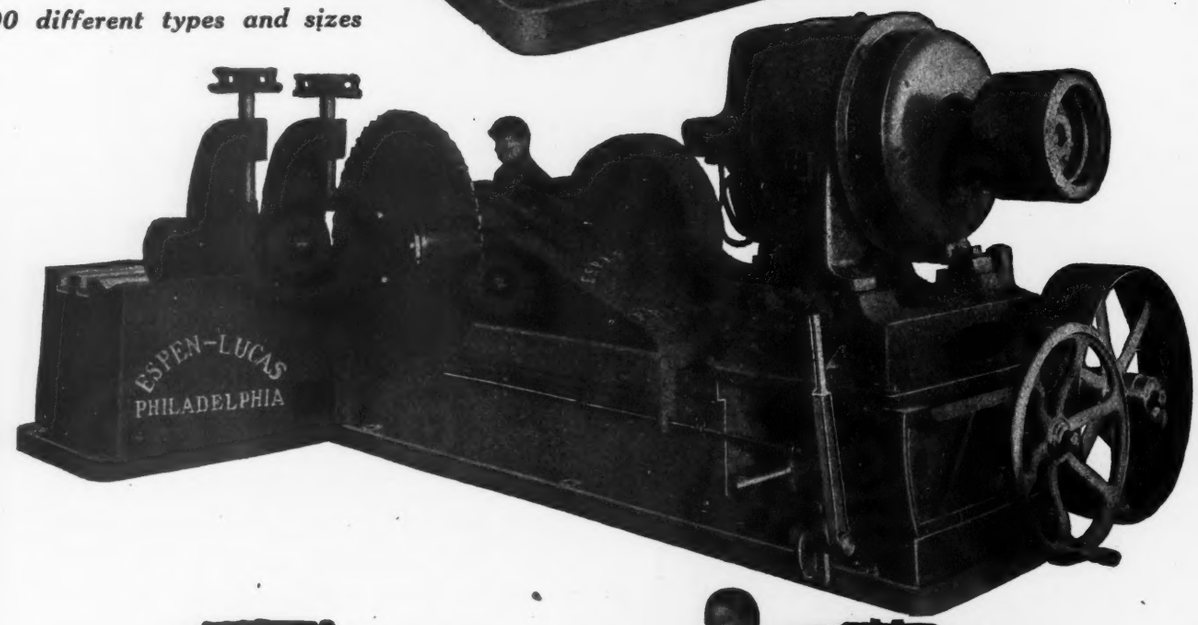
## THE WILLARD MACHINE TOOL CO.

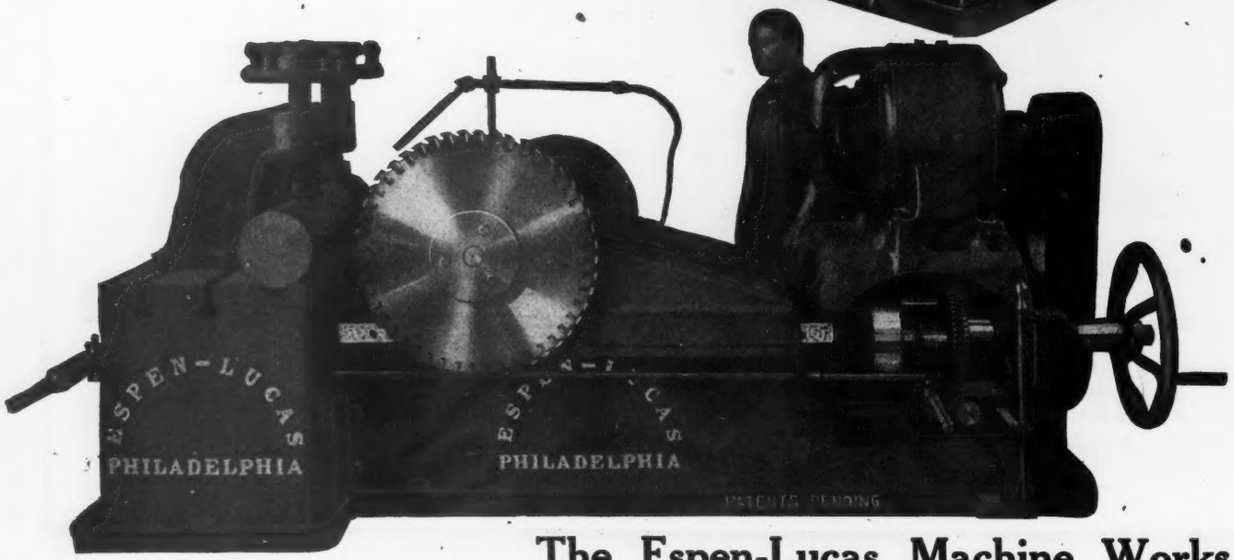
CINCINNATI A STREET, BOX 784 OHIO, U. S. A.




# FAST SAWING MACHINE

***190 different types and sizes***



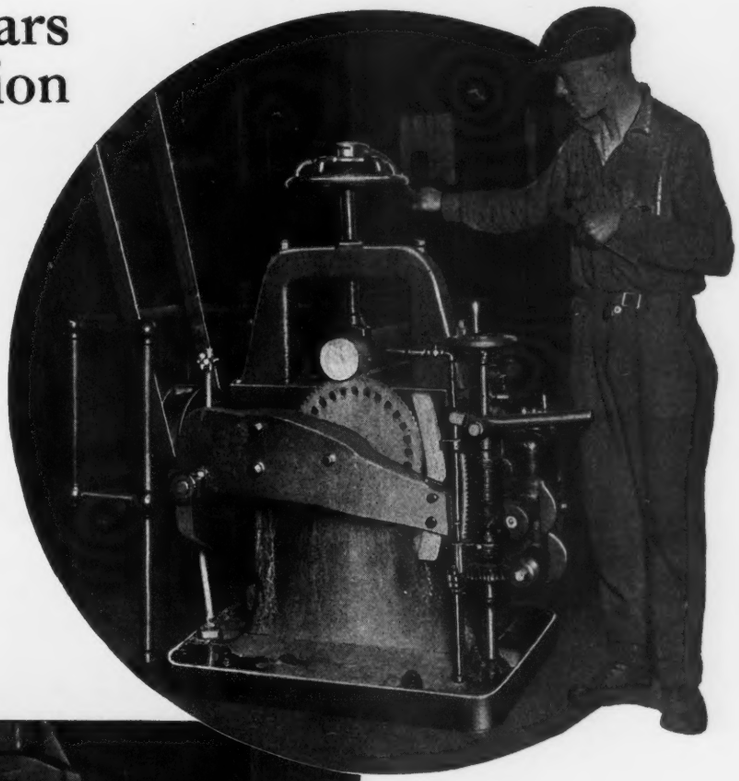

**The Espen-Lucas Machine Works**

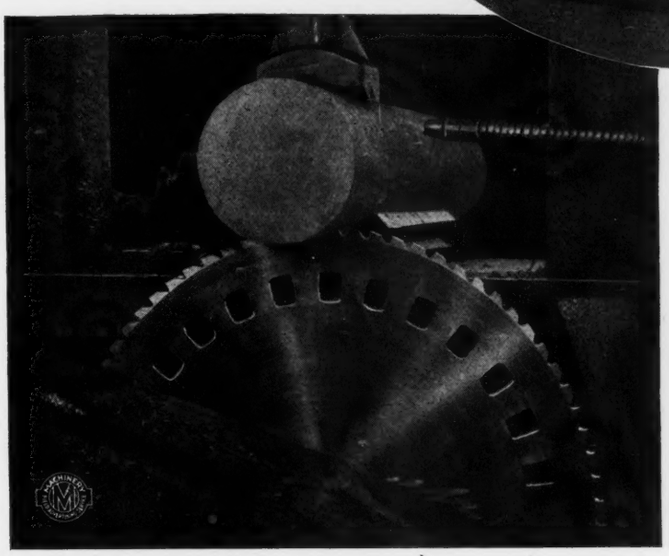
**Front and Girard Avenues** **Philadelphia, Pa.**

# LEA-SIMPLEX COLD SAWS

## Eleven Years of Satisfaction

The Connersville Blower Company of Connersville, Ind., has two Lea-Simplex Cold Saws, the first having been installed eleven years ago. These saws are kept busy cutting stock for shafts and other parts of Connersville Blowers.



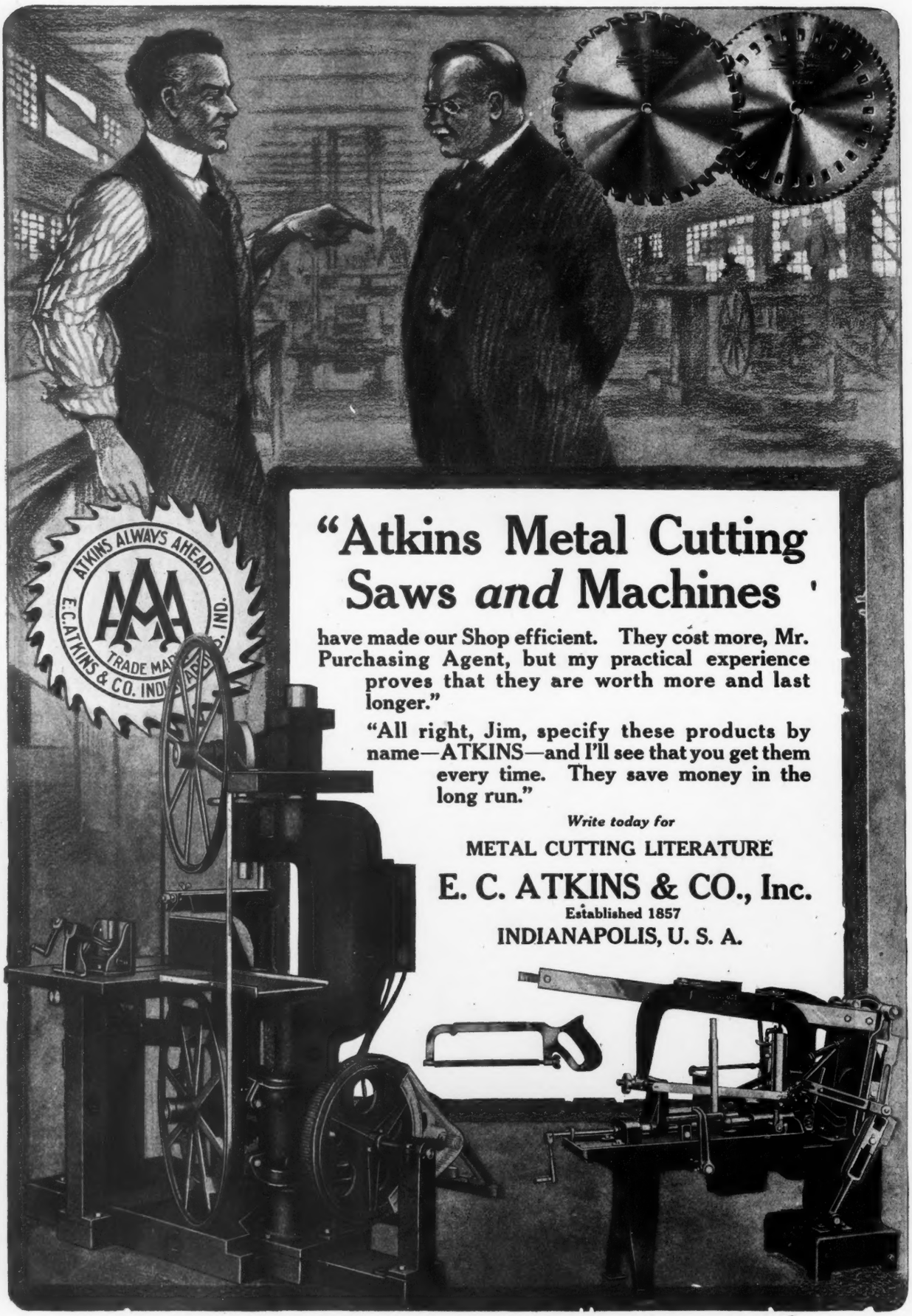


There are a number of good reasons for the superiority of Lea-Simplex Service.

Power is transmitted near the periphery—*near the actual cutting point.* The saw travels between carbon steel guides, and is pulled rather than pushed through the work. This places the saw in tension, and results in a steady, clean cut. Let us send details of all Lea-Simplex features.

## The Earle Gear & Machine Co.

4705 STENTON AVENUE PHILADELPHIA, PA.


ATKINS ALWAYS AHEAD
AAA
E.C.ATKINS & CO. INDIANAPOLIS, IND.
"Atkins Metal Cutting Saws *and* Machines
have made our Shop efficient. They cost more, Mr. Purchasing Agent, but my practical experience proves that they are worth more and last longer."
"All right, Jim, specify these products by name—ATKINS—and I'll see that you get them every time. They save money in the long run."
*Write today for*
METAL CUTTING LITERATURE
E. C. ATKINS & CO., Inc.
Established 1857
INDIANAPOLIS, U. S. A.

# *Changing Steel to Gold*

## with a

# NAPIER Band Saw Machine

Every grain of steel wasted is money lost — conversely, every grain *not wasted* means money saved.

As an example, we are making 100 cuts on a bar of high speed steel, 6"x6".

The band saw on the Napier Machine makes a .035" cut and removes only 30 and a fraction pounds of metal in comparison with an ordinary cold saw making a 3-16" cut which removes approximately 243 pounds of metal.

If your high speed steel costs say $1.50 a pound, the cost of wasted steel with a Napier is only $45 while the cost of the waste with the cold saw is $364. Subtract $45 from $364 and you have the tidy sum of *$319 to put in the bank* or for new machinery.

**The NAPIER BAND SAW MACHINE**
**is the only horizontal metal cutting band saw machine made.**

**is extremely rigid; lacks vibration; cuts straight.**

**is a fast cutter because every tooth of the saw is working.**

**Economizes on blades—the band wheels are large, therefore the saw doesn't check in the gullets.**

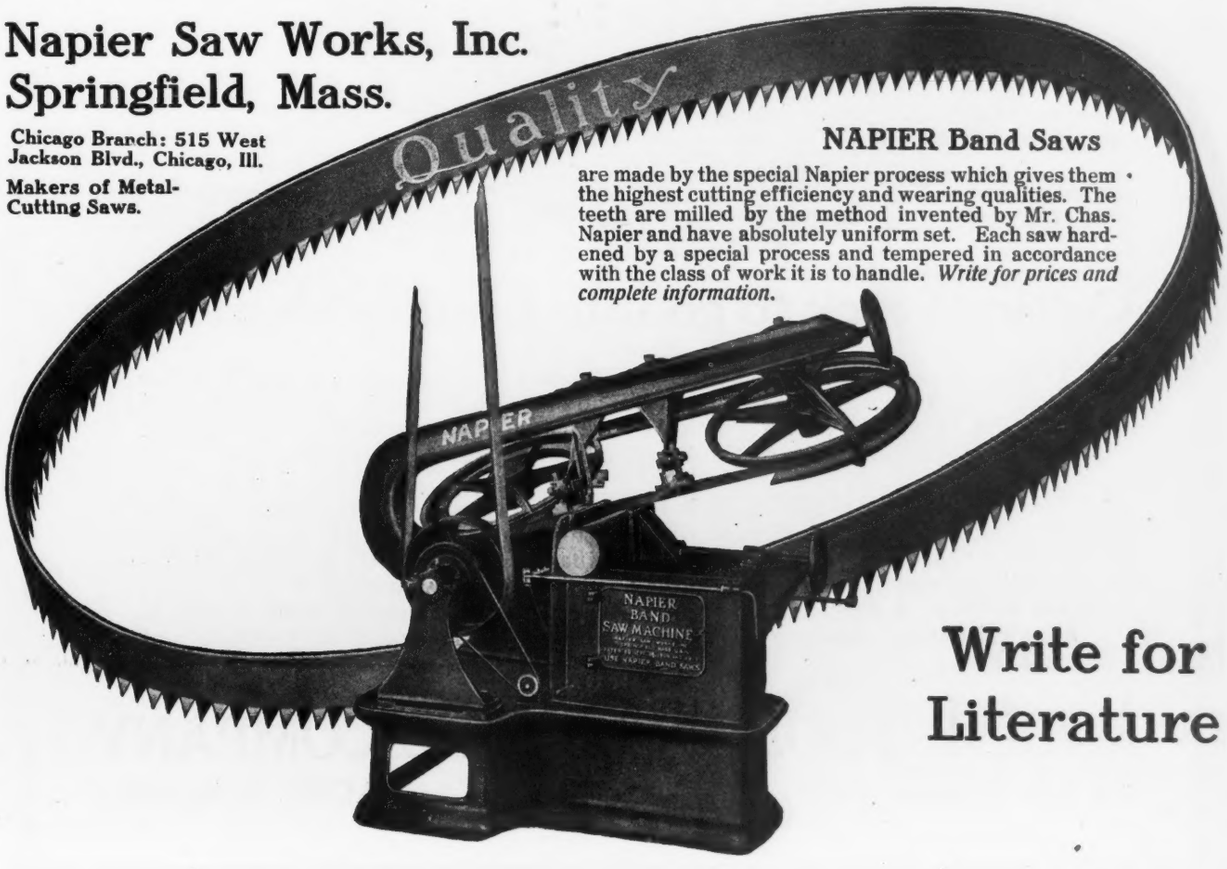
**Feeds into the work by gravity with a constant feeding weight.**

We make Hack Saws and Hack Saw Machines in addition to Napier Band Saw Machines and Metal Band Saws. Complete information upon request.

**Napier Saw Works, Inc.**
**Springfield, Mass.**

**Chicago Branch: 515 West Jackson Blvd., Chicago, Ill.**

**Makers of Metal-Cutting Saws.**




**NAPIER Band Saws**

are made by the special Napier process which gives them the highest cutting efficiency and wearing qualities. The teeth are milled by the method invented by Mr. Chas. Napier and have absolutely uniform set. Each saw hardened by a special process and tempered in accordance with the class of work it is to handle. *Write for prices and complete information.*

**Write for Literature**

# THE "RACINE"

## High Speed Metal Cutting Machine

*There's a "RACINE" for every class of metal sawing. Our circulars will help you choose the ones you need*

## Cutting Stock to go into Bradley Hammers

This busy machine has been working a steady 10-hour day for the last two years. Time enough to prove its value in the stockroom of C. C. Bradley & Son, Inc., (Syracuse, N. Y.) and to have cut many tons of stock as the first step in the manufacture of the famous Bradley Hammers.

The stock runs from 1½" to 6" in diameter and consists of low carbon machine steel and high carbon tool steel. This machine takes a blade 14" long, and like all THE "RACINE" Metal Cutting Machines, is equipped with the patented Automatic Lifting Device which raises the blade clear of the work on the non-cutting stroke. A high-grade machine—its accurate, economical work makes it a logical choice wherever the utmost efficiency is demanded of products and equipment.

## RACINE TOOL & MACHINE COMPANY

**250 15th STREET** **RACINE, WISCONSIN**

# WORK—
# AND WORK TOGETHER

Keep the issue clear.

There are so many problems—so many byways—so many conflicting or apparently conflicting interests—so much narrowness of vision—that there's no wonder if the issue does become clouded.

*What is the issue?*

The world's needs and the necessity of filling them.

There's no thought of keeping Europe in idleness nor is there any such desire on their part. But war has wrought such havoc—industry and commerce are so disorganized that we must help them get started so that they can help themselves.

And our own needs are sufficient in themselves to keep everybody hard at it for a long time to come.

Pessimism is out of order—prosperity will continue until the needs are met.

*How are we to meet the world's needs?*

The answer is simple and obvious—we must work. With all our advancement in knowledge, we have yet to find a substitute for work.

But that's not all—*we must work together.*

The partners of Industry—Helpers, Management and Capital—must get a wider vision; honestly seek the other fellow's interest for a change; thoughtfully and sanely put into practice the Golden Rule.

Keep the issue clear.

**Work—And Work Together**

## VICTOR SAW WORKS

**SPRINGFIELD**
**MASSACHUSETTS**
**U. S. A.**

# SIMONDS
## SAW STEEL PRODUCTS

## For Cutting Metal

There are no others which compare with Simonds Hack Saw Blades and Metal Cutting Saws, both Solid or Inserted Tooth. The famous Simonds Quality and Workmanship are found in all Simonds Products. They reduce the cutting cost and lead the way for business economy in industrial plants. Our Saw Steel Products are known throughout the world. Saw Makers for 87 years.

**SIMONDS MANUFACTURING CO.**

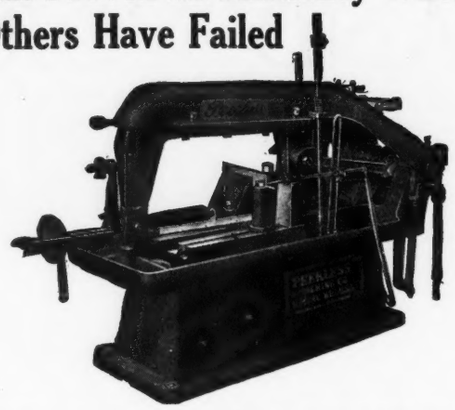
*"The Saw Makers"*

FITCHBURG, MASS.

CHICAGO, ILL. SAN FRANCISCO, CAL.
NEW YORK CITY NEW ORLEANS, LA.
PORTLAND, ORE. VANCOUVER, B. C.
LOCKPORT, N. Y. LONDON, ENGLAND
MONTREAL, QUE
MEMPHIS, TENN
SEATTLE, WASH.
ST. JOHN, N. B.

# Peerless HIGH SPEED

## Has Proven Its Efficiency Where Others Have Failed



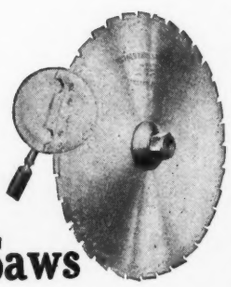
DON'T turn down the "Peerless" because you have tried out other hack saws which did not answer your requirements. Many concerns who were persuaded only with the greatest difficulty to try their first "Peerless," because they "just knew it would turn out like the others," are today among the largest and best satisfied users of our High-Speed Saws.

The "Peerless" is different—better. It does 50 to 100 per cent more work; cuts with thinner saws and requires a minimum of attendance, saving time, labor, material, blades and floor space.

What is your work? We can tell whether the "Peerless" will do it, and back our judgment with a 30-day trial. If it doesn't make good we pay freight both ways. Well?

**PEERLESS MACHINE CO.**
**1611 Racine Street, RACINE, WISCONSIN**

Another reason Why
# HUTHER
INSERTED
## Tooth Milling Saws
# are better



During the war when ordnance officers of the United States Army were looking for a milling saw that would do the most work and stand the wear, Huther Saws were the first choice.

They stood the test of the severe and constant strain put on them.

In shops where they hadn't been used before expert mechanics were astonished by their performance. You should use a Huther Inserted Tooth Saw. It will increase the output of your cut-off machine.

Send for one on approval. It may be returned at our expense if unsatisfactory.

HUTHER BROS SAW MFG. CO.
ROCHESTER, N.Y.

Write for our Catalog

# Metal Sawing Means

a very heavy strain on the machine and many damaged, broken and discarded saws, unless the saw teeth are scientifically sharpened and re-sharpened as often as required. This can be done only with automatic machines; and it is surprising at what low cost full automatic machines are now available for this service—various types of sharpeners for automatically re-sharpening metal cutting band saws one-quarter-inch or more in width, and circular saws one or two inches to seventy inches diameter.

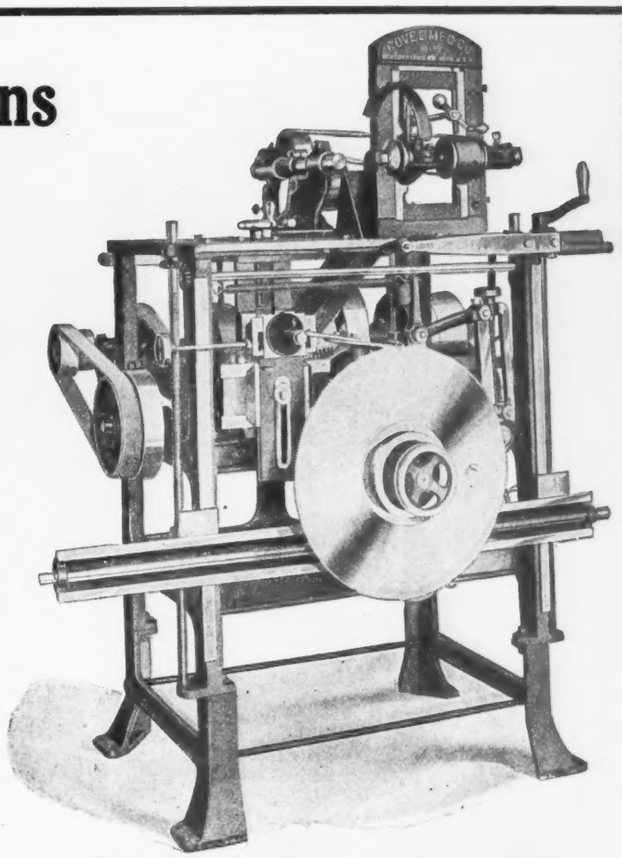
Only in this way can the teeth be kept uniform in size and shape and cutting efficiency—the grinding of each tooth uniform, contact of grinding wheel free from variation, no drawing of temper, and entire saw always kept to highest cutting efficiency, preventing cracks and broken saws, and insuring straight, smooth cuts. Hand grinding is now out of date.

Write for latest Metal Saw Sharpening Catalog of full automatic machines for all requirements.

**MACHINERY COMPANY OF AMERICA**

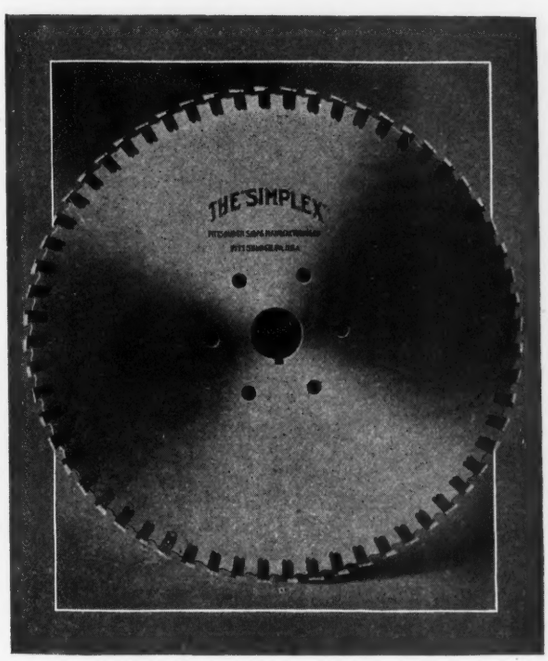
**BIG RAPIDS MICHIGAN, U. S. A.**

**Pacific Coast Office, 209 First Ave., So., Seattle, Wash.**



**No. 125 Automatic Sharpener for Hot and Cold Metal Cutting Saws**

# PITTSBURGH "SIMPLEX"




## The Saw with the Correctly Designed Inserted Teeth

Teeth and sockets of the Pittsburgh "Simplex" Saw are especially designed to afford maximum service and convenience. The teeth rest firmly on the bottoms of pockets, which are so constructed that screws are unnecessary. Plain wedges securely hold teeth in place, yet permit quick and easy removal or replacement. Split teeth are unknown to users of Pittsburgh "Simplex" Saws, the contacting surfaces of tooth and wedge being perfectly flat.

Pittsburgh "Simplex" Saws are widely used and appreciated in the steel country. In practically any of the big plants you'll find them industriously "ploughing" through high carbon and manganese forgings day after day all day long.

**We have something new in catalogs to send you. Write**

**The Pittsburgh Saw and Mfg. Co. PITTSBURGH, PENNA., U. S. A.**

# Sterling
## Hacksaw Blades

**Look for the name "STERLING" on the blade.**

HACKSAW Blades all look much alike, and very often feel alike when they are first used. It is only after finishing a tough job that the user can begin to see the difference. It is then that the word "Sterling" takes on a definite meaning. Made of the finest grade rolled high-tungsten alloy steel—by special machines and processes—the triumph of twenty years specialization in the hack saw field.

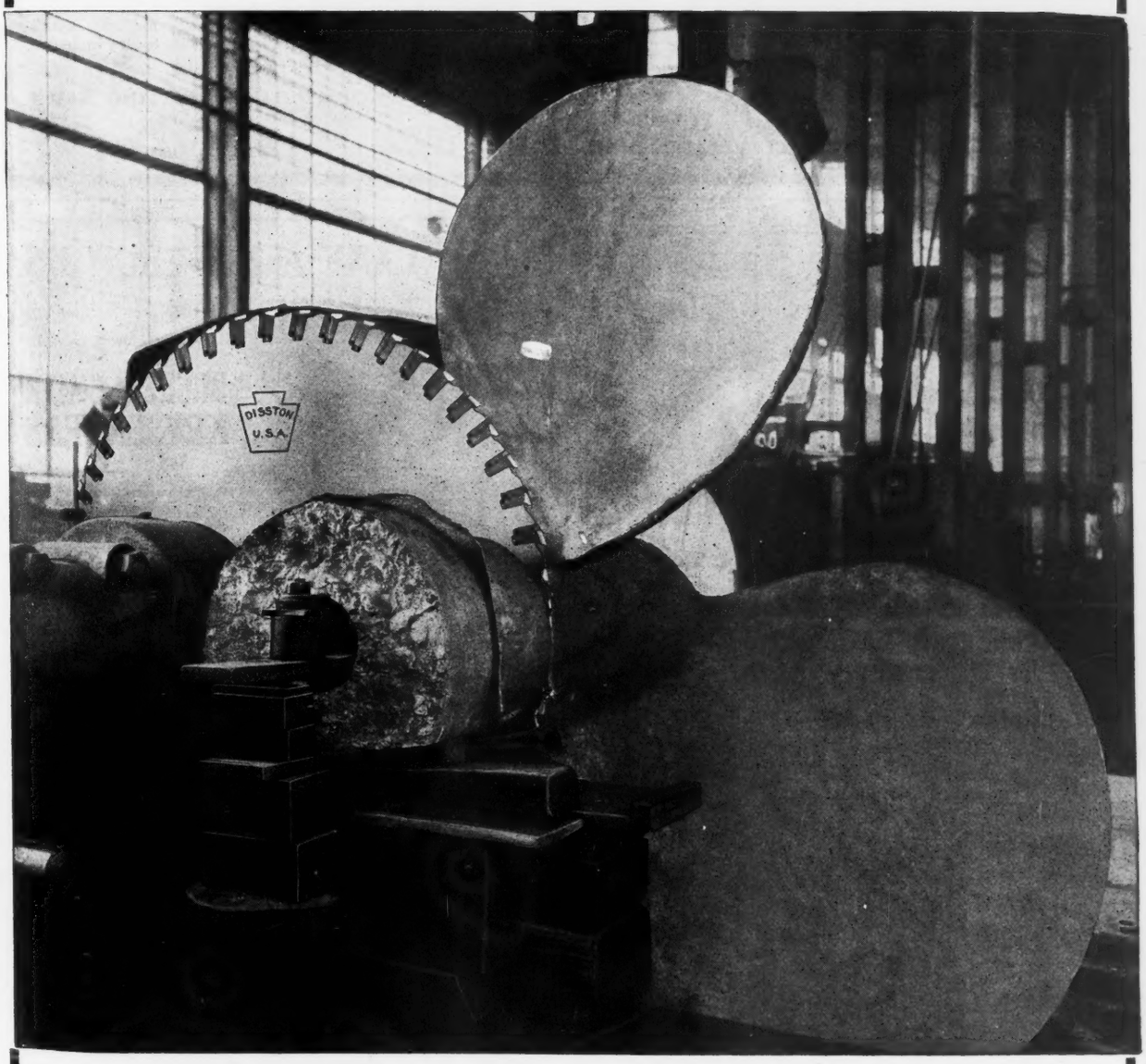
**Manufactured by**

**Diamond Saw & Stamping Works**

**357-361 Seventh St.**

**Buffalo, New York, U.S.A.**

# DISSTON INTERLOCKED INSERTED TOOTH CIRCULAR MILLING SAW




Cut shows 60 in. Circular Milling Saw, Disston Interlocked pattern of Inserted Tooth, teeth of High Speed Steel, all of the Disston manufacture. Saw being operated in the foundry of the Wm. Cramp & Sons Ship and Engine Co., Philadelphia.

This blade is being run at a speed of about 60 ft. rim motion, cutting through the hub of a manganese bronze casting 18 in. in diameter. Material named toughest manufactured for the purpose.

What we can do for our neighbors we can do for you.

*Write us for further details.*

DISSTON TRADE MARK REG. U. S. PAT. OFF.
*Established 1840*

## HENRY DISSTON & SONS, Inc.

KEYSTONE SAW, TOOL, STEEL AND FILE WORKS

PHILADELPHIA, U. S. A.

# AUTOMATIC MACHINES FOR SHARPENING SAWS

**ALL WOOD WORKING SAWS SUCH AS WOOD CUTTING BAND SAWS**

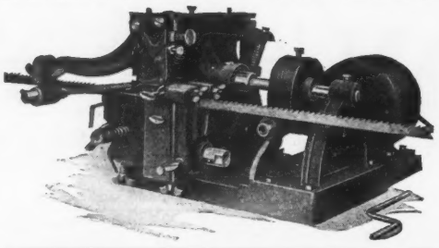
Can be filed and set in one operation by one machine, turned by hand, driven by belt, or by direct connected motor. (See cut).

**CIRCULAR SAWS** can be filed or ground.

**ALL SAWS USED BY BUTCHERS, PACKERS AND MEAT MARKETS**

Can be filed and set automatically by machine.

CABLE ADDRESS: FOLWELL



**The Wardwell Mfg. Co.**

**112 HAMILTON AVENUE**

**CLEVELAND, OHIO, U. S. A.**

**ALL METAL CUTTING SAWS SUCH AS POWER HACK SAW BLADES METAL CUTTING BAND SAWS**

Can be resharpened from six to eight times, each time renewing the life of the saw.

**CIRCULAR SAWS** for soft metals with teeth as fine as 32 to the inch can be sharpened by filing.

**COLD SAWS, SLITTING SAWS** resharpened by grinding.

WESTERN UNION CODE

# "HUNTER"

Hot Saws, Friction Discs, Solid Blades made of Vanadium, Tungsten and Chrome Alloy Steels. Saw Sharpening Machines. Inserted Tooth Grinders. Hardened Steel Specialties. Ask for catalog. Write for details.

**Hunter "Duplex"**

**Inserted Tooth Saws give lasting Satisfaction.**

*Ask us about them*

**Hunter Saw & Machine Co.**

Pittsburgh, Pa.

# TAKE A TIP FROM US

Write for full facts.

**Keep Your Machinery in Place. Moving is Costly**

**BUCHER-SMITH KEYSEATERS**

go to the job. They are speedy, accurate, easily operated. Cut keyways ¼" to 1¼" wide, 12" long in shafts 1¼" to 5" diameter without resetting.

**THE BUCHER-SMITH COMPANY**

*Engineers and Machinists*

EAST LIVERPOOL, O.

# EMERY WHEEL DRESSERS

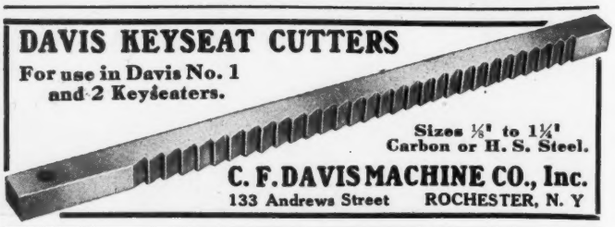
*Three Sizes* **CUTTERS** *Nos. 0-1-2*

We make the regular Huntington (Pattern) for all sizes
Roughing for No. 1 and 2. Paragon for No. 1 only

**GEO. H. CALDER,** LANCASTER, PA., U. S. A.

# DAVIS KEYSEAT CUTTERS

**For use in Davis No. 1 and 2 Keyseaters.**



Sizes ⅛" to 1¼"
Carbon or H. S. Steel.

**C. F. DAVIS MACHINE CO., Inc.**

133 Andrews Street ROCHESTER, N. Y

# The HIGLEY

**COLD METAL SAW**

*Catalog furnished by*

**Vandyck Churchill Co.**

New York Philadelphia New Haven

# LIBERTY HACK SAWS

*liberate you from Hack Saw troubles*

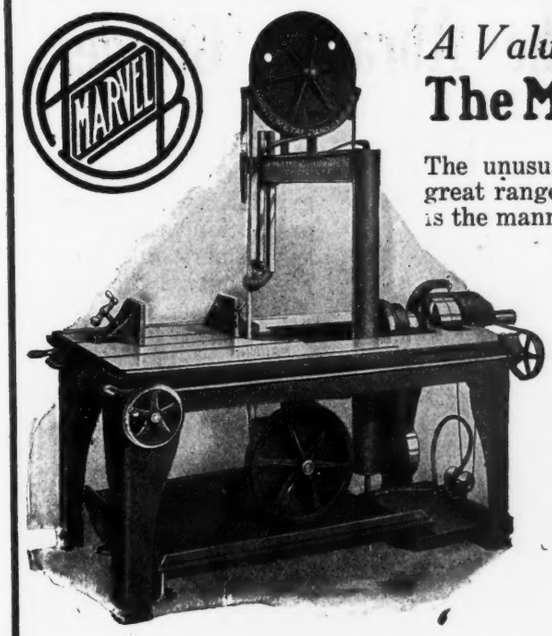
Liberty

Unless you have used Liberty Hack Saw Blades, you cannot fully appreciate their worth. The splendid service they render, standing up well under long usage, makes Liberty Hack Saw Blades of "the best in the long run" kind.

Your workmen can best appreciate Liberty Hack Saw Blades because theirs is the satisfaction or the grief when the tools with which they must work, do or do not come up to standard.

Next time you place your order for hack saw blades, try Liberty. They'll meet with your fondest imagination of what a good tool should be.

**STERLING PRODUCTS CO.** INC.
*Machinery Hall — CHICAGO*

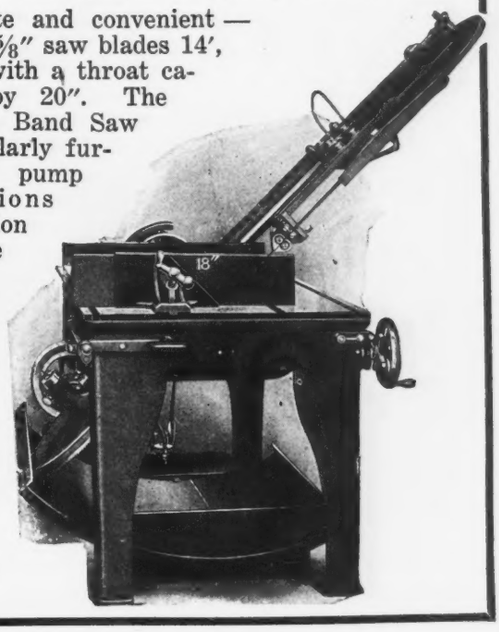


*A Valuable Angle On A Good Machine*

## The Marvel Metal Band Saw No. 8

The unusual design of this metal cutting band saw gives it great range, capacity and ease of operation. A valuable feature is the manner in which the saw blade, mounted on a rigid frame, may be tilted to an angle of 45 degrees right or left.

Rigid, accurate and convenient — made to take 5/8" saw blades 14', 8" long and with a throat capacity 18" by 20". The Marvel Metal Band Saw No. 8 is regularly furnished with pump and connections for lubrication —but may be had for dry cutting when specified — belt or motor drive.

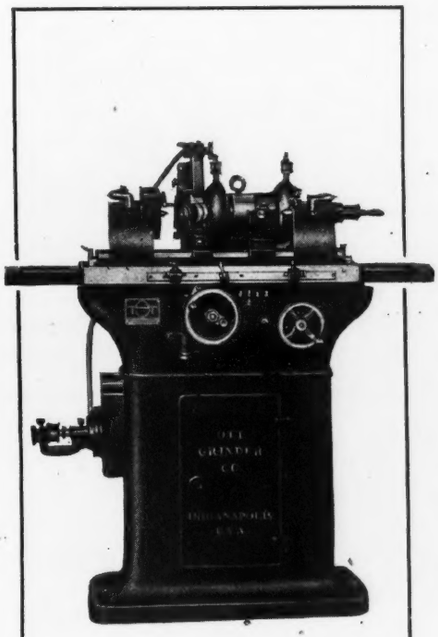


*Send for our Catalogue No. 4.*

**ARMSTRONG-BLUM MFG. CO.**

343 N. Francisco Avenue

CHICAGO ILLINOIS, U. S. A.



The Ott 5 x 18 Plain Grinder
5 in. Swing. 18 in. between centers

# Simplified Grinders

## The Ott 5-in. x 18-in.

Ott 5-in. x 18-in. plain grinding machines have been simplified in order that grinder production may be increased. They have been stripped of complicated adjustments, unnecessary parts; weight has been added where added rigidity is necessary for very accurate work; only the best of metals are used in vital parts; proper work speeds and feeds have been carefully developed to allow the machine to operate at its best speed for the work to be ground. They are compact, thus allowing operators to develop high and sustained natural speed.

The Ott 5-in. x 18-in. plain grinder is SIMPLE—RIGID—ACCURATE—COMPACT—all of which enables you to purchase a grinder at a low price that will pay you large returns for your investment.

**OTT GRINDER COMPANY**

West Tenth Street INDIANAPOLIS, IND.

# Increased Production

During the past two years you undoubtedly were forced to use anything in the shape of a GRINDING WHEEL.

By maintaining our HIGH QUALITY we have made many very good friends.

Now you are settling down to normal business, why not try our GRINDING WHEELS?

We may be able to increase your production as we have done in many cases.

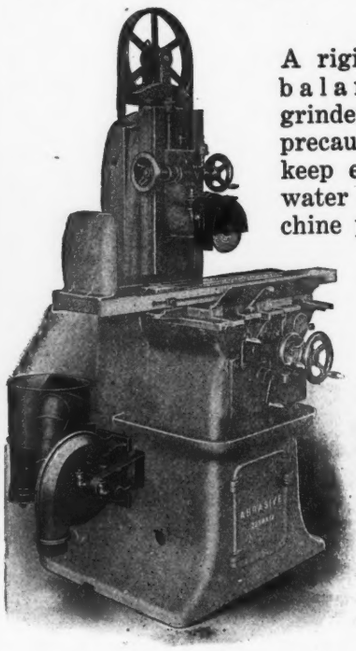
**NATIONAL GRINDING WHEEL COMPANY, INC.**

2986 MAIN ST.
BUFFALO, N. Y.

*Manufacturers of*
"THE WHEEL THAT TALKS FOR ITSELF"

NATIONAL GRINDING WHEEL COMPANY INC.

# The Abrasive Grinder



A rigid, heavy, well-balanced modern grinder, with every precaution taken to keep emery dust and water out of the machine proper.

Cut shows the machine equipped with **exhauster attachment,** consisting of exhauster with centrifugal dust separator and special wheel hood equipped with adjustable dust guard.

***Write for Details***

**ABRASIVE MACHINE TOOL CO.**
EAST PROVIDENCE F. N. MacLeod, Pres. and Gen'l Mgr. RHODE ISLAND

## CUT YOUR GRINDING COSTS

Not only in initial outlay but in general shop grinding practice. The **NATIONAL** is the easiest to set up, will do anything any other grinder will do and many things no other grinder can do. Can be used for external or internal grinding clear down to the washer (motor never in the way) on lathe, shaper, milling machine or planer. Unexcelled for grinding Cutters, Arbors, Reamers, Mandrels, etc., between centers, on small or large lathes. SKF ball bearings throughout.
The **NATIONAL** is the grinder you have been waiting for. Send for circular and full details.

**NATIONAL MACHINE TOOL COMPANY, Racine, Wisconsin**

STERLING

## Universal Cutter and Reamer Grinder

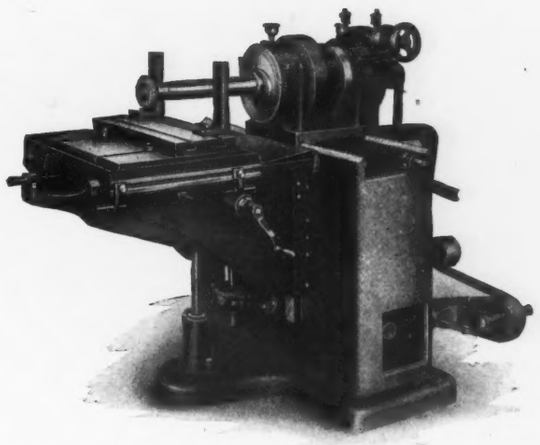
Will meet the most exacting demands of your tool room

***Ask for complete description***

**McDONOUGH MFG. CO.**
EAU CLAIRE WISCONSIN

## MADISON CYLINDER GRINDER

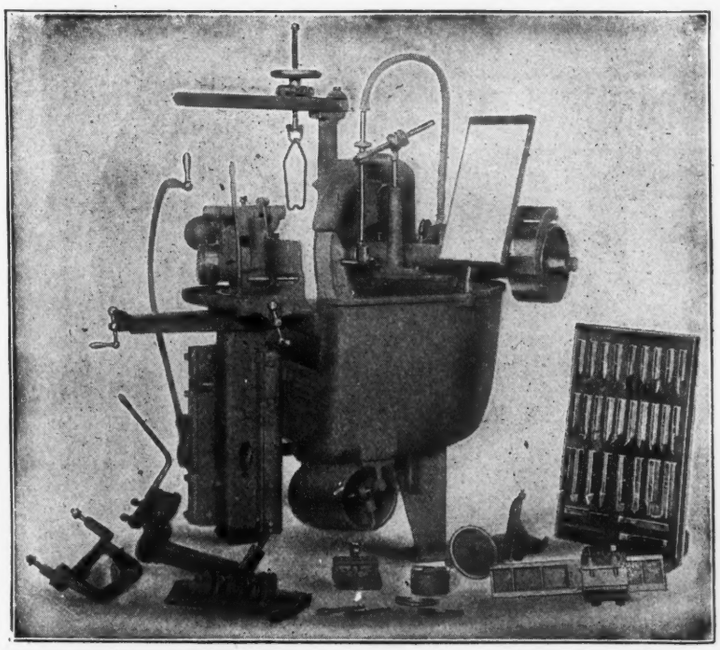
A simple, rigidly constructed cylinder grinding machine particularly adapted to a wide range of work.



*Write for particulars*

MADISON MACHINE TOOL COMPANY
609 East Washington Avenue Madison, Wisconsin

William Sellers & Co., Incorp.
PHILADELPHIA, PA.



## LABOR SAVING MACHINE TOOLS

For quickly, accurately and economically forming and sharpening cutting tools for lathes, planers, slotters, etc.

**The Sellers Tool Grinder Has No Equal**

It produces and duplicates shapes and angles at a surprising saving over any other method.

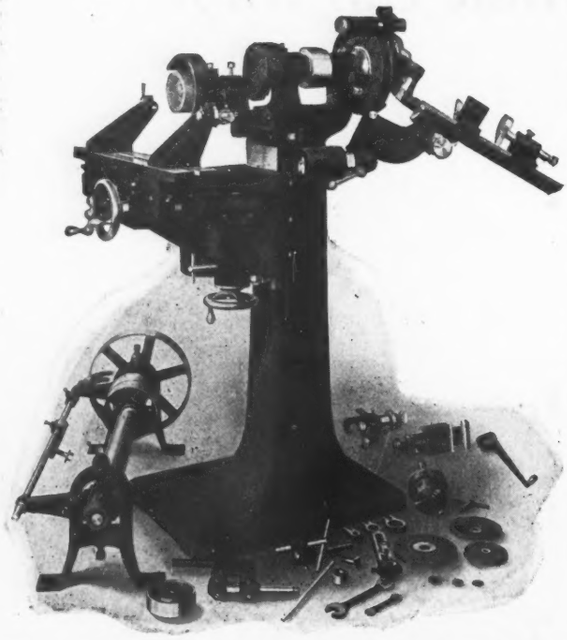
Does not require a mechanic for operator.

**Saves Grinding Time Saves Money**

Because of its large output, accurate work and low cost of maintenance, it is found so valuable as to be practically indispensable.

## SHAFTING DRILL GRINDERS

# A MOVE IN THE RIGHT DIRECTION



Business is good—we're just getting around to it. But it isn't war work, and don't forget it. This trip there's going to be competition; and competition cuts profits unless you're equipped.

Make a move in the right direction *now.*

Have twist drills ground just right, for instance. If you've ever tried to put a hole through with a blunt or lopsided drill, you know how costly that is.

Sharpen them by machine—get a Grand Rapids Drill Grinder now—*it really, actually and positively grinds drills correctly.*

***We are staking our reputation on each machine***

## GRAND RAPIDS GRINDING MACHINE CO.

**29 Ottawa Avenue, N. W.** **Grand Rapids, Michigan**

Maximum Efficiency

# MAXF

GRINDING WHEEL

Profitable wheels with a reputation founded on service; standard equipment in the grinding rooms of discriminating manufacturers all over the country; efficient wheels for all classes of grinding from foundry to tool room.

All sizes, shapes, grains and grades shipped promptly from stock. Good deliveries on "specials" and duplication guaranteed.

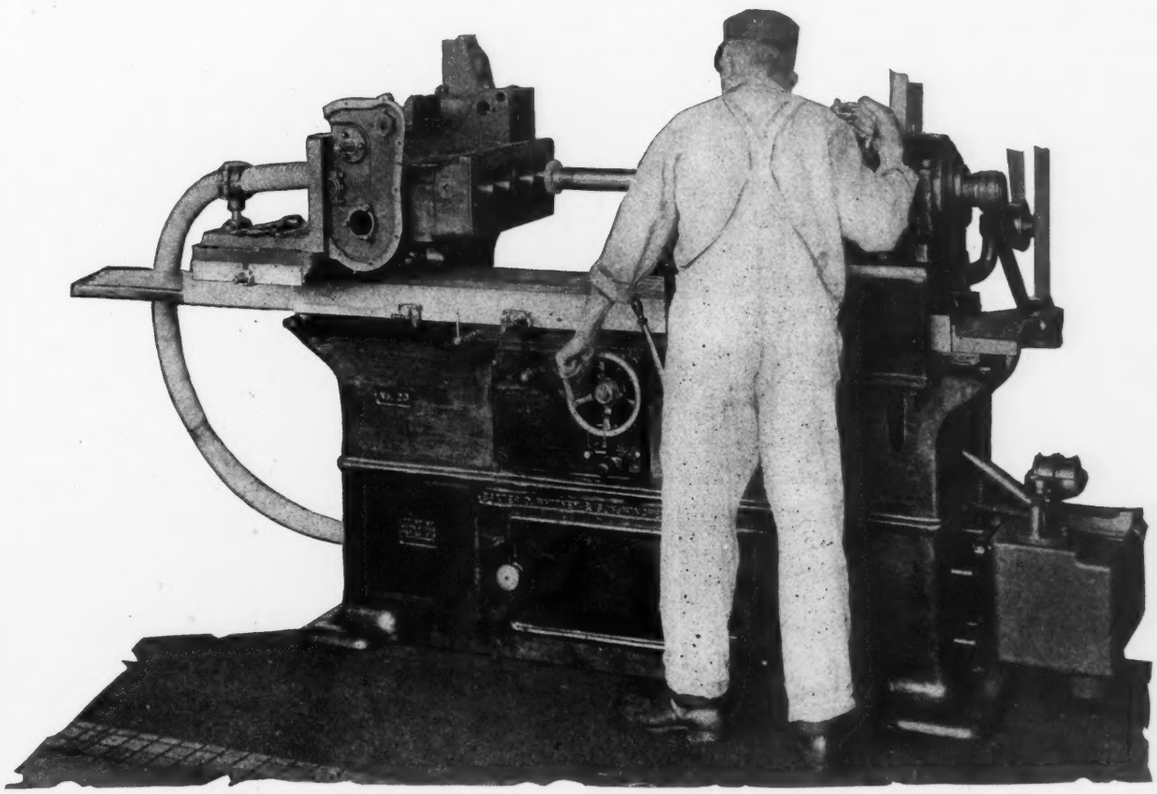
***Catalog lists full line***

**MAXF GRINDING WHEEL CORPORATION**

**CHESTER, MASS.**

# WHITNEY
# CYLINDER GRINDER

**FOR GRINDING ALL KINDS OF GASOLINE ENGINE CYLINDERS AS WELL AS WORK TOO LARGE OR TOO HEAVY TO REVOLVE**



**No. 23 Cylinder Grinder at work regrinding automobile cylinders**

**Machines furnished to grind holes from 3" up to 7" diameter and 14" deep. Also equipped to grind holes as large as 14" diameter and 25" deep.**

***Let us send you our new booklet. Write for it.***

## BAXTER D. WHITNEY & SON, Inc.

DOMESTIC AGENTS: E. A. Kinsey Co., Cincinnati, Ohio. Strong, Carlisle & Hammond Co., Cleveland, O., and Detroit, Mich. E. L. Essley Machinery Co., Chicago, Ill. The Motch & Merryweather Machinery Co., Pittsburgh, Pa. Machine Tool Engineering Co., New York City. Sherritt & Stoer Co., Philadelphia, Pa. Carey Mchy. & Supply Co., Baltimore, Md.

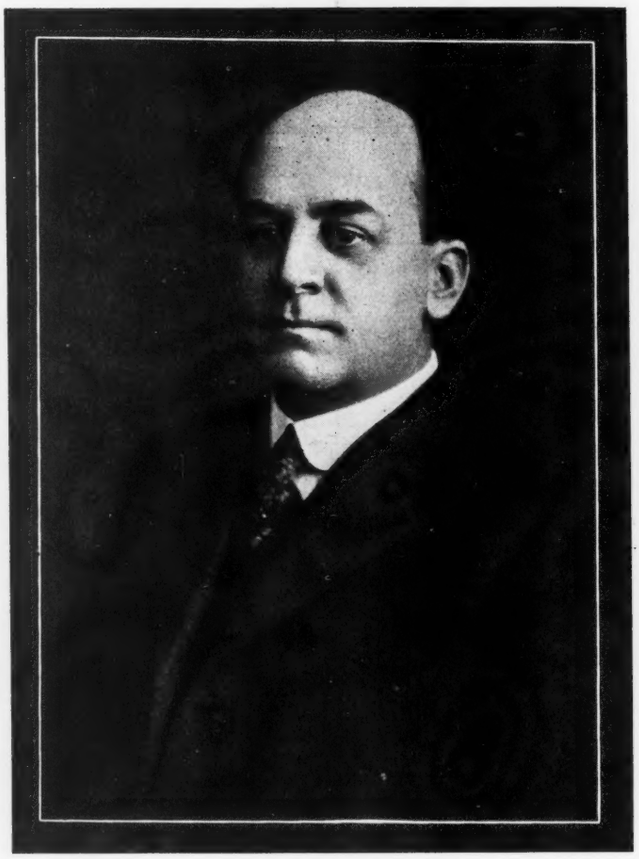
**WINCHENDON MASSACHUSETTS U. S. A.**

PACIFIC COAST AGENTS: Portland Mchy. Co., Portland, Ore. Perine Mchy. Co., Seattle, Wash. Pacific Tool & Supply Co., San Francisco, Cal. CANADIAN AGENTS: Canadian Fairbanks-Morse Co., Montreal, P. Q. FOREIGN AGENTS: Buck & Hickman, Ltd., London, England. Fenwick Freres & Co., Paris, France.

# The Man from Norton's

Norton service is a departure from the ordinary methods. Most of us have been accustomed, when purchasing, to trade a check for a machine, and call it a deal. In our plans, however, Norton interest extends over the entire life of the machine.

New customers confronted with our representative's card a short time after their Norton installation often express astonishment when informed that the caller has not come to solicit the purchase of further machines, but to see that those in place are doing themselves justice. If your needs justify increased grinding equipment our service man will tell you so—*but he's not on the road only to sell machines.*



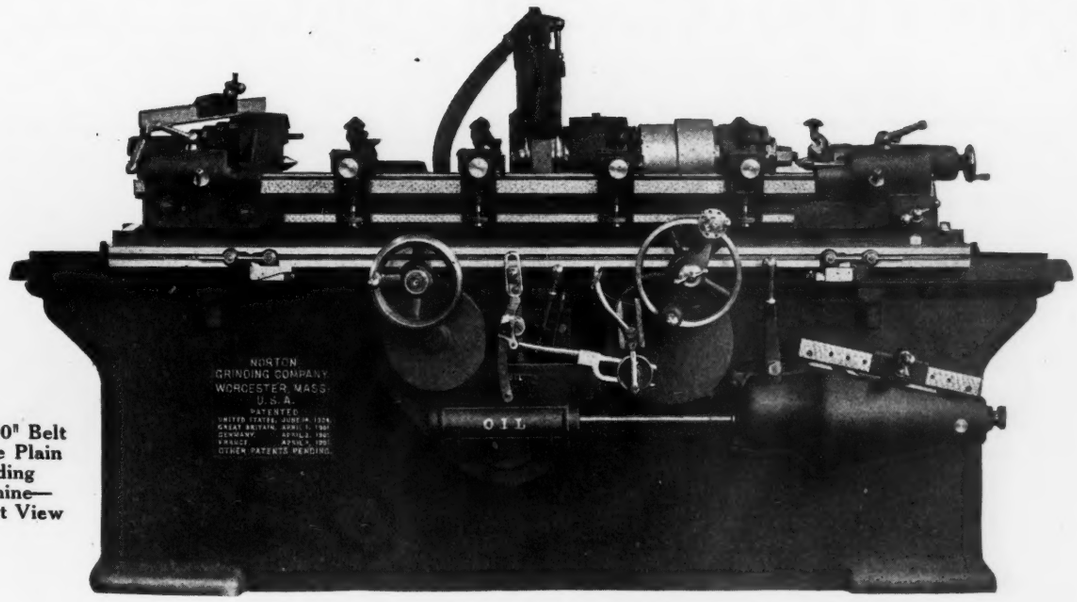
OUR Representative, Oscar Knight, Headquarters, Motch & Merryweather Machinery Company, 707 Lakeside Avenue, N. W., Cleveland, Ohio. To get him quickly, wire headquarters.

Note his district on the map—the automobile center of the country.

Mr. Knight is an expert on grinding as applied to gas engines and motor cars. Give him a day in your plant.

NORTON GRIND

# Would Like to Meet You




**10x50" Belt Drive Plain Grinding Machine—Front View**

We desire at all times to keep up the friendly relations which exist between our clients and our house. It is our constant endeavor to maintain those high standards of efficiency which have for many years characterized the Norton Grinding Machine. We count your good will our greatest asset. To keep it we have put a grinding expert in your district. If you use Norton Grinding Machines he'll tell you how to get the utmost out of them. If you don't, he'll give you an unbiased production estimate on your work done the Norton way.

Whose territory are you in? New York and Chicago districts covered by Messrs. Wickstrom and Cudworth, respectively, have already been shown.

## NORTON SERVICE

**Covers the Continent in the Interests of Good Grinding**

**WATCH THESE PAGES FOR THE MAN IN YOUR DISTRICT**

## NORTON GRINDING CO., Worcester, Mass., U. S. A.

**Chicago Store, 11 North Jefferson Street**

AGENTS: Vonnegut Machinery Co., Indianapolis, Ind. Robinson, Cary & Sands Co., St. Paul, Minn., Duluth, Minn. Manning, Maxwell & Moore, Inc., St. Louis, Mo. Henry Prentiss & Co., Inc., New York, N. Y., Boston, Mass., Buffalo, N. Y., Rochester, N. Y., Syracuse, N. Y., Scranton, Pa. The Motch & Merryweather Machinery Co., Cleveland, O., Detroit, Mich., Pittsburgh, Pa., Cincinnati, O. Eccles & Smith Co., San Francisco, Cal., Los Angeles, Cal., Portland, Ore. The Canadian Fairbanks-Morse Co., Montreal, Que., Toronto, Ont., Vancouver, B. C. C. T. Patterson Co., Ltd., New Orleans, La. Kemp Machinery Co., Baltimore, Md. W. E. Shipley Machinery Co., Philadelphia, Pa. English Tool and Supply Co., Kansas City, Mo. Alfred Herbert, Ltd., Coventry, Eng., Paris, France, Milan, Italy. The F. W. Horne Company, Tokyo, Japan. Iznosskoff & Company, Petrograd, Moscow and Ekaterinburg, Russia.

ING MACHINES

# Watch This Space for "Gardner" Ads

Beginning with the September Issue of this publication, we will feature our very complete line of

# GARDNER DISC GRINDERS

## in this space

Live, interesting views of Gardner Grinders at work in the factories of many prominent manufacturers will be shown.

## Watch For These Views!

From them you will learn of some of the surprising operations which YOU can do on Gardner Grinders, and will discover how many manufacturers do much of their machining.

**Look Up the "Gardner" Ad in the September Issue—and Look Each Succeeding Month Also**

## GARDNER MACHINE COMPANY

**414 Gardner St., Beloit, Wisconsin, U. S. A.**

NEW YORK OFFICE, 6 Church Street

CHICAGO OFFICE, 32 N. Clinton Street

Representative in Great Britain, The Alfred Herbert Co., Ltd., Coventry, England. Representative in Paris, Turin, Zurich and Barcelona, The Allied Machinery Company of America, 51 Chambers St., New York, N.Y.

# Piston Ring Grinding at its Best

THE degree of exactness now required on these important parts necessitates the use of a grinder that will give great production with a high percentage of perfect work.

Persons-Arter Grinders are gaining wide popularity on ring grinding due to their ability to take heavy roughing cuts or fine finishing cuts and present the smooth, mirror-like surface desired.

Being equipped with an automatic magnetizing and demagnetizing switch, the operator is concerned only with loading and unloading the chuck.

The number of cutting strokes per minute is variable so that production is limited only by the skill of the operator in handling the work.

THE

**PERSONS-ARTER MACHINE CO.**

72 COMMERCIAL STREET

WORCESTER, MASS., U. S. A.

# BLANCHARDIZED

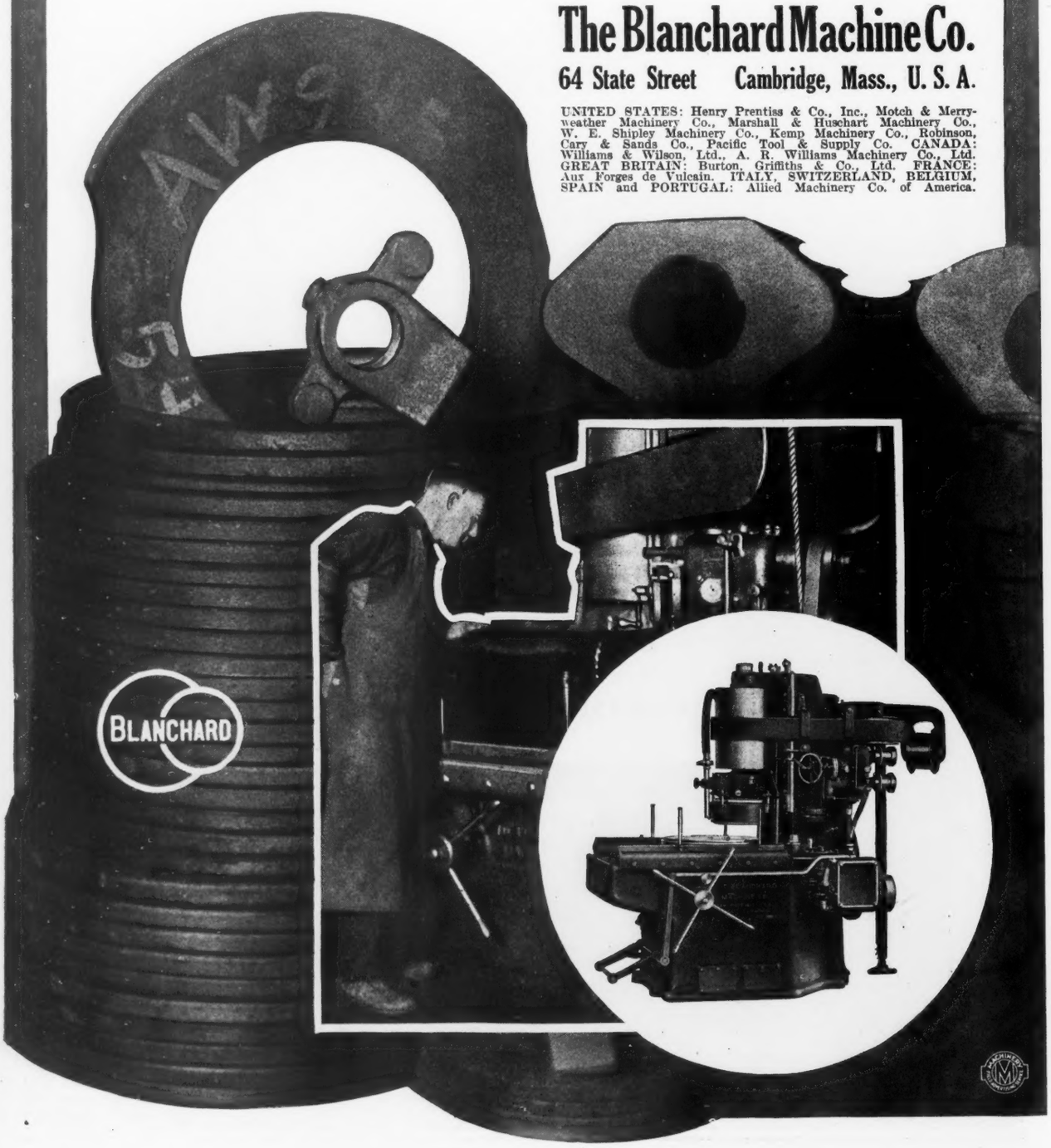
There are ten different kinds of work in this pile, ranging from 2″ thick and 25″ across largest diameter down to a size which permits mounting 50 at a time on the Blanchard chuck. Limits on all parts are plus or minus 0.001″ or closer. Some must be held to within plus or minus 0.0005″. One class of pieces is chilled iron—finished from the rough on the Blanchard Grinder. This machine was installed about four years ago in a large glass machinery plant.

*A word to the wise - Blanchardize!*
*Get the Catalog.*

**The Blanchard Machine Co.**

**64 State Street Cambridge, Mass., U. S. A.**

UNITED STATES: Henry Prentiss & Co., Inc., Motch & Merryweather Machinery Co., Marshall & Huschart Machinery Co., W. E. Shipley Machinery Co., Kemp Machinery Co., Robinson, Cary & Sands Co., Pacific Tool & Supply Co. CANADA: Williams & Wilson, Ltd., A. R. Williams Machinery Co., Ltd. GREAT BRITAIN: Burton, Griffiths & Co., Ltd. FRANCE: Aux Forges de Vulcain. ITALY, SWITZERLAND, BELGIUM, SPAIN and PORTUGAL: Allied Machinery Co. of America.

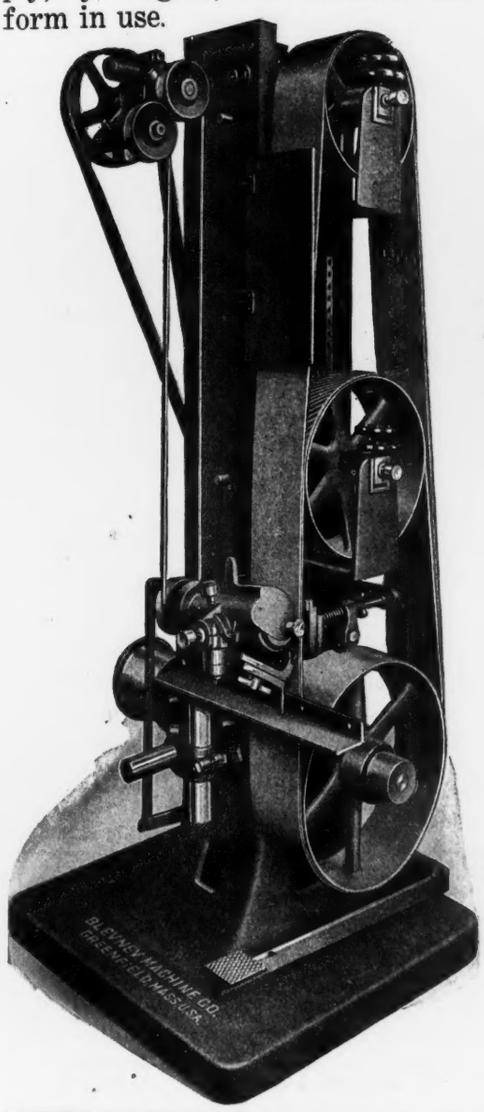


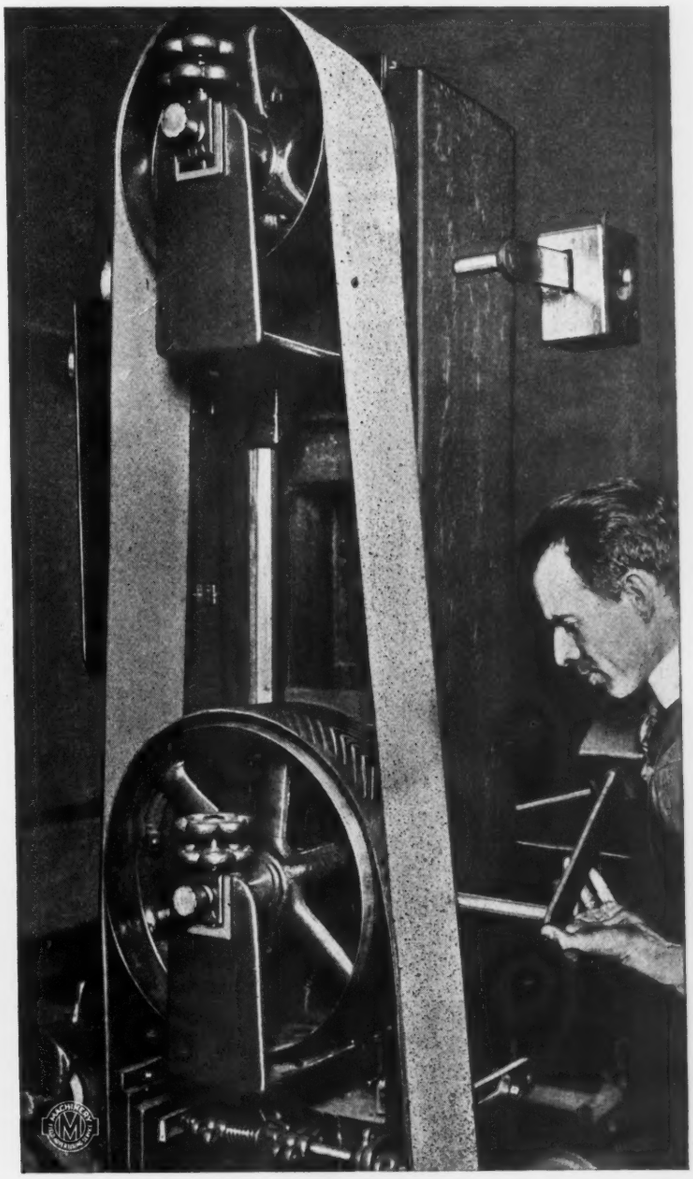
# BLEVNEY

## Patent Finishing Machines

### As Easy to Adjust As They Are to Run

Among the many good points of Blevney Type "A" Polishing and Finishing Machines is the ease with which they are adjusted and changed from one job to another. In the upper photograph the operator is seen altering the belt tension. This is regulated very simply, by weights, and remains uniform in use.



The lower photograph shows the power feed roll for finishing round stock with great rapidity. Without the feed roll, flat and irregularly shaped stock is handled.

It's the two-belt principle which makes Blevney production figures so remarkable. The corrugated belt under the abrasive belt makes the latter present a surface to the work which gives both maximum cutting efficiency and adequate clearance for the chips.

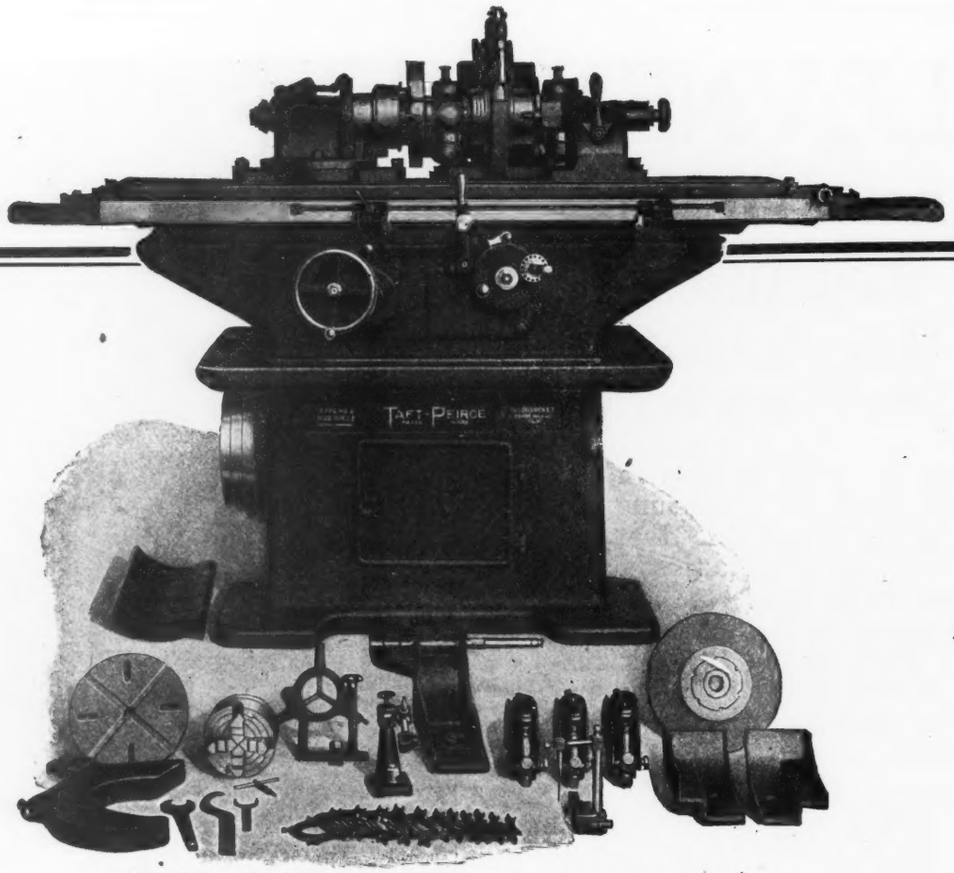
*Is there a Blevney for doing your work? Write and find out.*

## BLEVNEY MACHINE CO.

**GREENFIELD MASS., U. S. A.**

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST. NEW YORK, U.S.A.

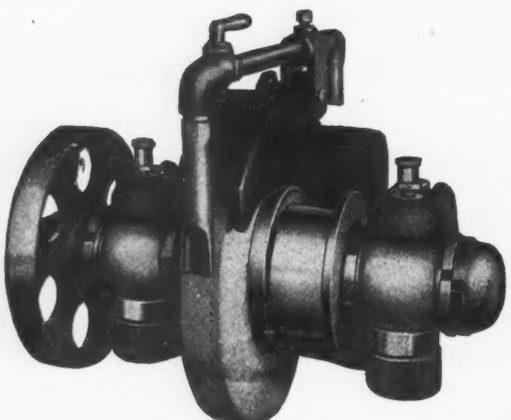
**CADILLAC TOOL CO., Dodge Power Building, Detroit Agents for Michigan.**




Taft-Peirce No. 2 Universal Machine, 10 in. x 30 in. Capacity.

# Universal Grinding Machine

TRADE T-P MARK



Wheel head and spindle.

**Some Details:**

The T-P Universal Grinder has automatic cross feed—8 work speeds—10 table speeds—three wheel speeds—takes grinding wheels up to 12-in. diameter, 1½ in. thick—is furnished with countershaft, tight and loose pulleys—internal grinding attachment—two grinding wheels—4-jaw chuck—universal back rests—center rest—tooth rest—dogs—water guards—wrenches, complete ready to operate.

A compact, versatile machine for straight or tapered, plain, cylindrical or internal grinding.

Eight spindle speeds and ten table feeds provide capacity for a wide range of work and at the same time extreme accuracy of grinding.

A disc clutch and brake are provided in the headstock so that the spindle can be stopped and started at will, without stopping any part of the countershaft.

Send for descriptive bulletin No. 103B.

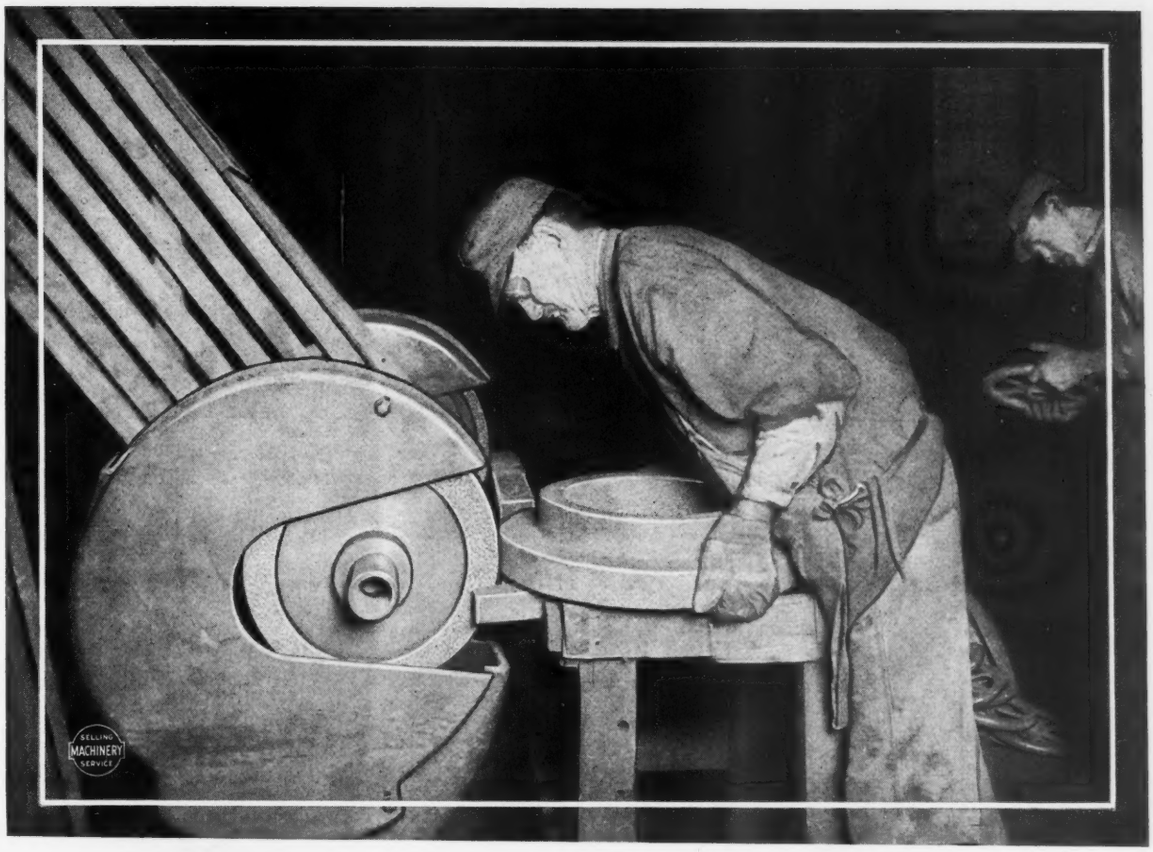
TAFT-PEIRCE
Woonsocket, R.I., U.S.A.

New York, Woolworth Building Detroit, Majestic Building
Chicago, 1211 E. Marquette Rd. Cleveland, 10708 Hampden Ave.

TAFT-PEIRCE PRODUCTS CARRIED IN STOCK BY
Syracuse Supply Company, Syracuse, Buffalo, Rochester,
Cadillac Tool Co., Detroit. Sherritt & Stoer Co., Philadelphia.

2068

# Hampden Corundum Wheels



*The Hampden Book contains many interesting facts about Corundum —mining, manufacture and application. Send for a copy.*

## *Starting the Tenth Inch*

The 15″ wheel in the photograph is all that's left of a 24″ Hampden Corundum Wheel. The tenth inch grinds just as efficiently on these iron and steel castings of various sizes, shapes and condition as the first did. The photograph was taken in the plant of the Hempfield Foundry, of Greensburg, Pa.—an "All-Hampden" shop. The grinding wheels here are subjected almost continually to the roughest kind of service. They "stand up" because Hampden Corundum Wheels are *really good* grinding wheels.

## Hampden Corundum Wheel Co.

**Springfield, Mass., U. S. A.**

# ABRASIVE
## GRINDING WHEELS

Boro-Carbone
TRADE MARK

Electrolon
TRADE MARK
Silicon Carbide

**Used for the Roughest and the Finest Jobs**

In the center of a large shop, where safes and safety vaults are made, stands this Abrasive Grinding Wheel. Used all day by many men for many jobs, this "wheel-of-all-work," as it is called, has much service to its credit.

A tour of this plant reveals a full line of Abrasive wheels; the work ranging from the finest grinding jobs, all the way down to snagging, removing scale, truing up ends of bars, etc., the latter going largely to the wheel illustrated. Abrasive Grinding Wheels are long lasting, free cutting, thoroughly satisfactory. Use them with confidence.

***Let us help you select the best Abrasive Wheels for your work.***

**ABRASIVE CO.** MAIN OFFICE AND WORKS: **BRIDESBURG, PHILADELPHIA**

Chicago Store: 566 WEST WASHINGTON BOULEVARD

# THE WEBSTER & PERKS Universal Grinding Machine

## Checking the Accuracy of the Surfaces

The photograph below shows the testing of surfaces that are to become parts of the Webster & Perks Universal Grinding Machine No. 2. When the hand of the dial indicator registers no deviation whatever, a surface is accepted as O. K. The parts on the surface plates are the wheel stand and the cross feed slide. All other parts with slide and table surfaces are handled with the same exactness.

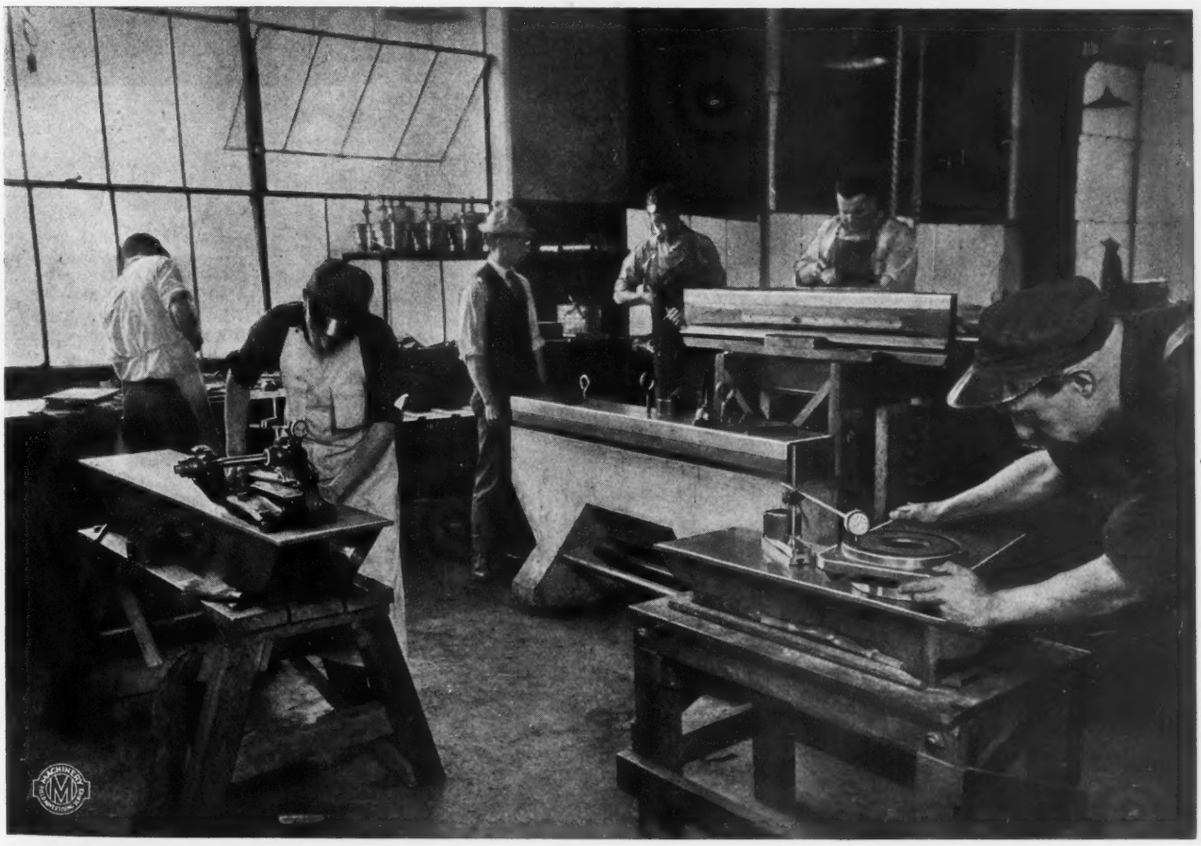
We do not want to anticipate our story by describing the final grinding test, but, in suggesting it, you will realize how impracticable this would be without the predetermined co-ordination of all the working surfaces. We realize that machines retaining in their members any minute fiber stresses, any "negligible" irregularities of surface, which are ordinarily expected to "wear smooth" after a while, contain within them at the beginning of their mechanical career as a kink in their service guarantee a positive nucleous of error.

Planes which are plainly perfect satisfy our inspection.

**The Webster & Perks Tool Company**

SPRINGFIELD P.O.Box1301 OHIO,U.S.A.

*"The Internal Grinding Fixture in Action" will be the subject of next month's discussion. Be sure to look for it.*

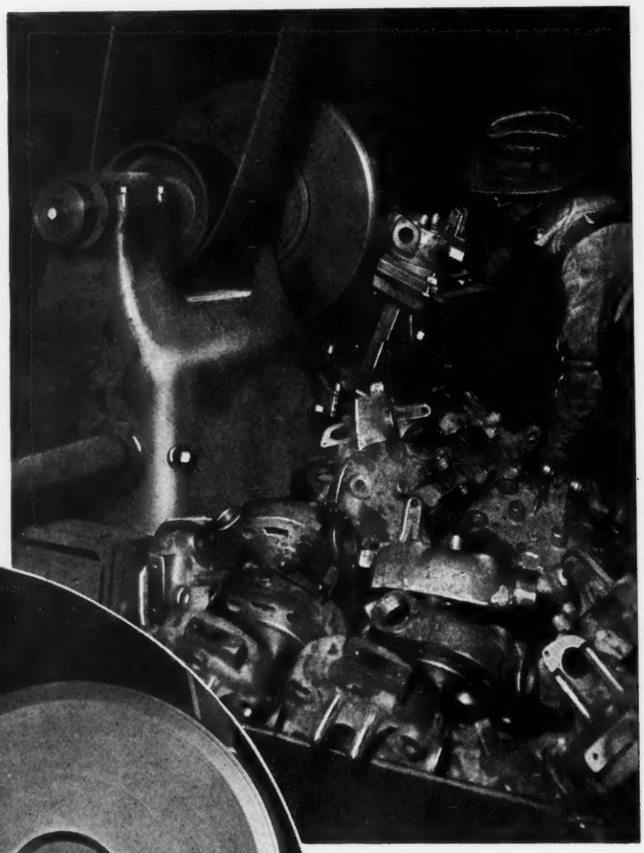


# BESLY GRINDING

BESLY CHICAGO

## *Jumped Output from 300 to 830 Surfaces per Day*

The pictures show a Besly Grinder in the Nelson Bros. Co.'s shop at Saginaw, Mich., grinding two surfaces on cylinder heads for Nelson Gas Engines—one rectangular, 3½" by 1"; the other oval, 2⅞" by 3½". About 1/32" of metal is removed from each. The surfaces are 90° apart, and an indexing mechanism is used for positioning.



BESLY CHICAGO

Up to the time the "Besly" was installed—about a year ago—this work was handled on a milling machine which turned out 150 finished castings or 30 surfaces per day. Comparison with the "Besly" figures, noted above, is sufficient to account for the popularity of Besly Grinding in this shop and indicates the advisability of a prompt investigation in connection with your surfacing problems. Catalog on request.

## CHARLES H. BESLY & COMPANY

*Originators of Disc Grinders*

120-B NO. CLINTON STREET CHICAGO, ILL., U. S. A.

Notes On Grinding
NORTON COMPANY WORCESTER, MASS.

No. 46

# Results With Crystolon Wheels on Cast Iron Castings

FOR some time Norton Crystolon (Silicon Carbide) wheels have been unusually successful in snagging cast iron castings.

Demonstrators were proving this and reports received from wheel users were in general satisfactory.

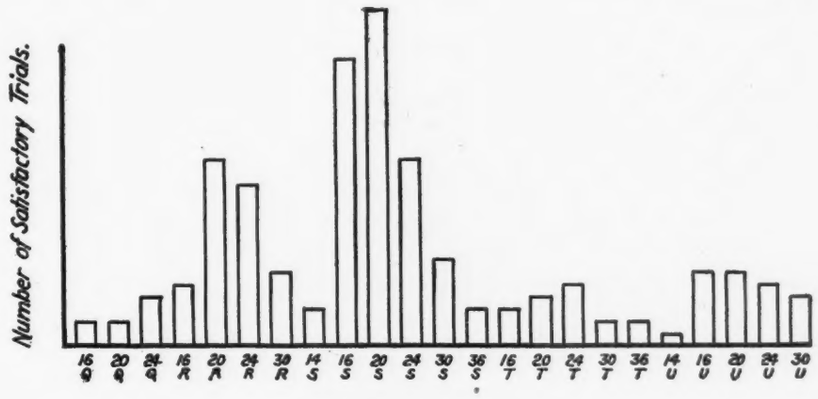
When we found, however, that of 116 trials 85 per cent were satisfactory and a Norton Crystolon wheel adopted as standard, the opportunity came to make definite statements of work actually accomplished. We found on investigation that our trial records showed an average of 17 wheels out of every 20 as satisfactory for all trials.

A Crystolon wheel 14 x 2 x 1½", 16 grade S, used on a swing frame machine for snagging structural iron castings, ground 160 tons, twice as much as any competing wheel had ever ground at the plant where the trial was held.

A 14 x 3", 2" rim 16 grade R Crystolon wheel held up for 55 hours under very hard usage and was 50 per cent better than the competing wheel.

The chart, which is the result of our investigation, shows the various wheels tried in this particular form of grinding with the resultant most satisfactory wheel.

It is not to be understood that there were an equal number of trials of each grain and grade. It is drawn up merely to illustrate the general direction of our recommendations.




*Grain and Grade.*

This is a further demonstration of the value of being able to

1. Recommend correct grains and grades.
2. More closely duplicate satisfactory wheels.
3. Give you the benefit of Norton Service.

JUST ONE OF THE MANY PRECISION GRINDING JOBS ON WHICH

ALOXITE WHEELS

HAVE MADE POSSIBLE A GREATER ACCURACY; A GREATER PRODUCTION AND A GREATER SAVING IN TIME AND IN GRINDING COSTS

The work is grinding piston rods in an Eastern New York shop—the wheel holds its shape assuring a perfectly round rod, cuts free and fast without chattering, leaving a splendid commercial finish—and it shows a real economy in increasing production and in its long life.

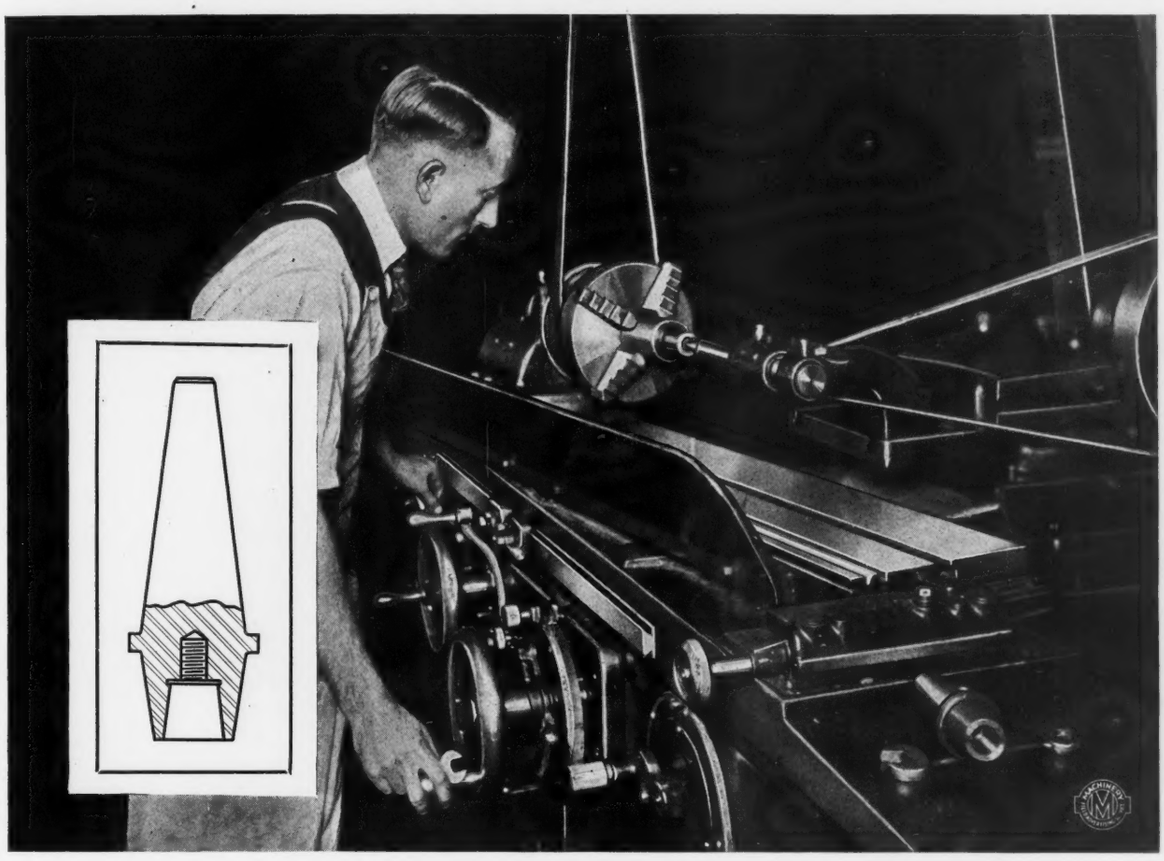
.....

*Suppose you put some of your grinding work up to our service department.*

THE CARBORUNDUM COMPANY

NIAGARA FALLS, N. Y.

NEW YORK CHICAGO BOSTON PHILADELPHIA CLEVELAND CINCINNATI PITTSBURGH MILWAUKEE GRAND RAPIDS



# CINCINNATI

## UNIVERSAL GRINDER

*How Do You Grind the Odd Jobs?*

The Thorn Machine Tool Works, Syracuse, N. Y., finds its Cincinnati No. 2 Universal Grinder invaluable for all kinds of tool, die, jig and fixture work. This shop does a large jobbing business, so the universality of the machine has been fully tested and approved.

When photographed, it was grinding pack-hardened arbors for turret lathes —rigged for internal work, with the table set over to taper 3″ per foot. As indicated in the sketch, clearance at the bottom of the hole is very small, requiring instant and accurate reversal of the table at every traverse.

*Odd jobs of grinding are never a problem with a Cincinnati Universal Grinder about the place. How do you handle such work in your shop?*

**THE CINCINNATI GRINDER CO.**

**CINCINNATI** **OHIO, U. S. A.**

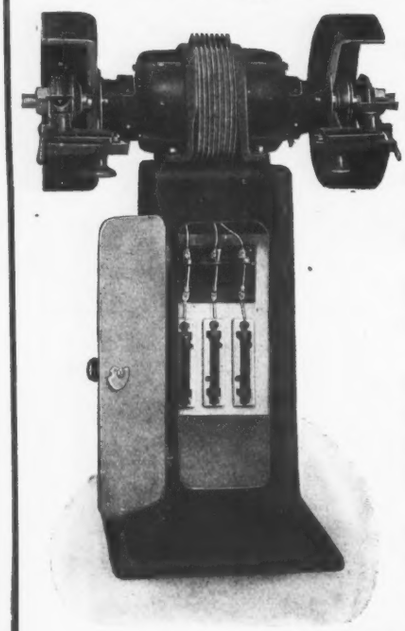
# Diamo-Carbo Emery Wheel Dressers

Keep your grinding wheels trued—frequent dressing means accurate work. Diamo-Carbo Emery Wheel Dressers, as effective as diamonds at less cost, offer an economical means for getting the best results from your wheels. Send for the circular—try the tools at our expense.

**DESMOND-STEPHAN MANUFACTURING CO.** URBANA O., U. S. A.

The Canadian Desmond-Stephan Mfg. Co., Ltd., Hamilton, Ont. Alfred Herbert, Ltd., Agent for Great Britain.

# RANSOM Grinding Machines



No Belts

Neat

Compact

Dustproof

Made for All Currents

Cut shows 12" Machine known as No. 11

Highest Grade Workmanship

We make Motor Driven Grinders for Wheels 12" diameter to 30" diameter

**RANSOM MFG. CO.,**
OSHKOSH WIS., U. S. A.

## CADY *of* CANASTOTA HAND SURFACE GRINDER

Designed to grind flat surfaces fast and true. Has 9" rapid longitudinal feed, 6" slow feed, by hand wheel with .001" graduations, and the vertical adjustment is 9".

***Complete Description in Circular***

**PRICE $150**

C. N. CADY CO., Inc.
CANASTOTA, NEW YORK, U. S. A.

# Bridgeport Wet Tool Grinder

## DIRECT CURRENT MOTOR DRIVEN

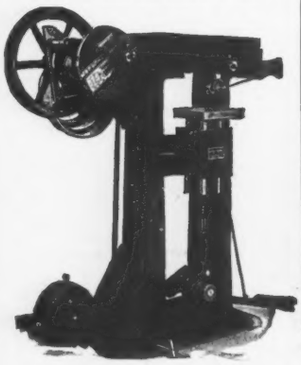
A rigid, heavy machine with motor bolted to a bracket cast with the base.

Standard height splash bowl, enclosed base, which forms the water reservoir. Centrifugal or air pump as desired.

Listed on page 80 of our new Catalogue C. Send for it.

**BRIDGEPORT SAFETY EMERY WHEEL CO. Inc.,** 83 KNOWLTON ST. BRIDGEPORT, CONN.

# MARKING



## Dwight Slate Marking Machines

cut lasting impressions at low cost.

Catalogue No. 5 describes the machine, lists the users and shows specimens of sample plates.

Our contract department for die stamping and steel engraving is up-to-date and at your service.

## Noble & Westbrook Automatic Surface Grinder

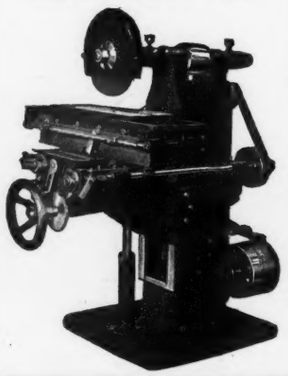
has a capacity for work 8" by 20", cacurate adjustments with ample compensation for wear and is thoroughly dust proofed.

Furnished with or without magnetic chuck as desired.

Catalogue?

**NOBLE & WESTBROOK MFG. COMPANY**
19 ASYLUM STREET HARTFORD, CONNECTICUT

# GRINDING



# The Capital Internal Grinder

## Promotes Production

*The facts are in Bulletin No. 2. Write for a copy.*

The question of profit or loss frequently rests with the machine. Especially is this the case in the bulk production of duplicate parts. Ease in handling the pieces is as important as speed in finishing them, and in both these particulars the Capital Internal Grinder meets modern requirements.

The very high speed at which the Capital is designed to run is rendered practicable and safe by mounting the spindles on SKF Self-Aligning Dust Proof Ball Bearings. The sturdy construction and rigidity of the various parts eliminate vibration and assure accuracy.

The Capital grinds holes 3/16" to 2" diameter up to 2" in depth, accurate within limits of .0001".

**LANSING STAMPING & TOOL CO.**

LANSING MICHIGAN

# "Vitrified" Grinding Wheels

**for Satisfactory Grinding Service**

*Catalog Lists Full Line*

The satisfaction of Vitrified Grinding Service is due to the high standards that prevail in every department—from selecting and compounding abrasives and bonding mixtures to our system of accurate duplication on repeat orders. Fast, cool cutting and non-glazing. Vitrified Wheels are carried in stock in all standard and many special styles and sizes.

**VITRIFIED WHEEL COMPANY**

WESTFIELD MASSACHUSETTS, U. S. A.

# Take a Good Look at this Grinder

Table is rigidly supported by box type knee which entirely encircles the column and has 12" longitudinal, 5" cross and 7¾" vertical travel. Head swivels through 180° and universal vise has three swivels. Elevating and cross traverse screws are fitted with micrometer dials. These and other features recommend it, and a wide range of attachments makes it practical equipment for general tool and cutter grinding.

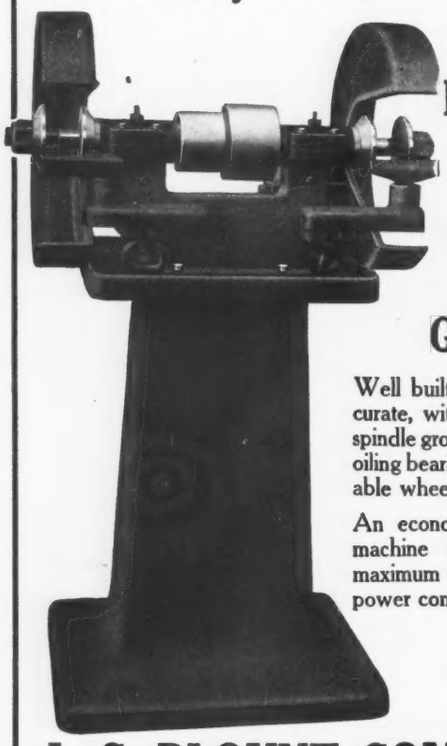
**WOODS Universal Tool and Cutter Grinder**

*Details on Request*

*Made in Three Sizes*

**WOODS ENGINEERING CO.** ALLIANCE OHIO, U. S. A.

## For Economy of Power and Space



## THE BLOUNT No. 5 TWO WHEEL DRY GRINDER

Well built, rigid and accurate, with carbon steel spindle ground to size, self-oiling bearings and adjustable wheel guards.

An economical grinding machine that does the maximum of work for the power consumed.

*Circular?*

**J. G. BLOUNT COMPANY**
EVERETT MASSACHUSETTS

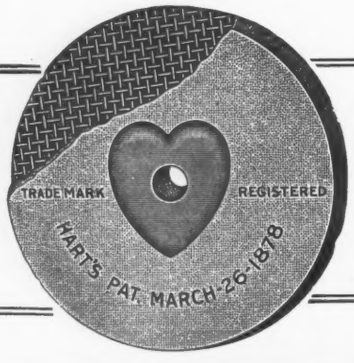
## For Profit in Grinding Specify

## "STAR" WHEELS

To make your balance sheet show substantial profits—by eliminating spoiled work, constant dressing and truing and experimenting on reorders—to insure rapid, uniform, economical grinding output, specify "Star" Wheels for all your grinding machines.

*Catalog lists full line*

**STAR CORUNDUM WHEEL CO.**
DETROIT MICH.
New York Office, 9-11 West Broadway,
New York City. C. H. Westerberg, Mgr.




Wire Web and Solid Grinding wheels for all Purposes

# DETROIT Grinding Wheels

Comparative tests have shown Detroit Wire Web Wheels (Hart's Patent) to be stronger and better able to resist strain than other wheels. Made by carefully chosen scientific processes of the best natural and artificial abrasives, Detroit Grinding Wheels are cool, fast, clean cutting, satisfactory wheels for all grades of work.

*Let us tell you about them.*

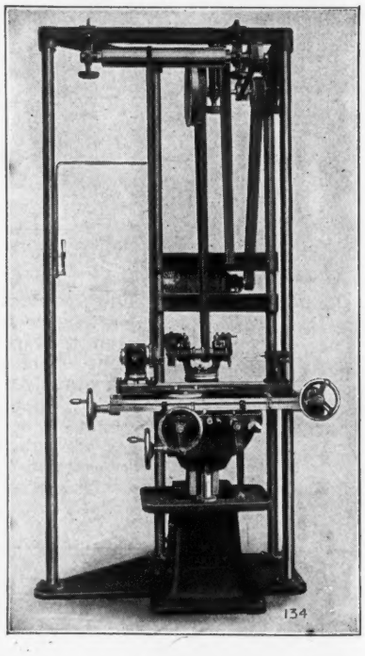
**DETROIT GRINDING WHEEL CO.**
DETROIT MICHIGAN, U. S. A.

# OAKLEY No. 2
## MOTOR DRIVEN
## Universal Cutter and Tool Grinder

Built as a Grinder should be. Heavy, rigid and accurate—well adapted to all forms of tool room grinding.

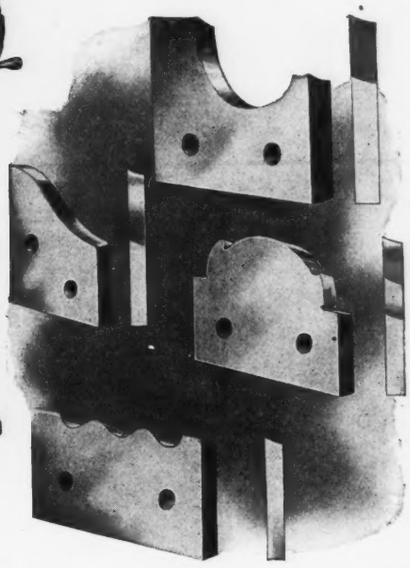
*Let us send complete details*

**The Oakley Machine Tool Co.**
Oakley
Cincinnati, Ohio



# A Matter of Minutes—or Days?

Do you have to wait two or three days to get flat tools from the tool maker—or do you use the Fischer Profile Grinding Machine? The Fischer grinds to correct form irregularly shaped flat tools —a matter of minutes.



*Circular gives further details. Send for it.*

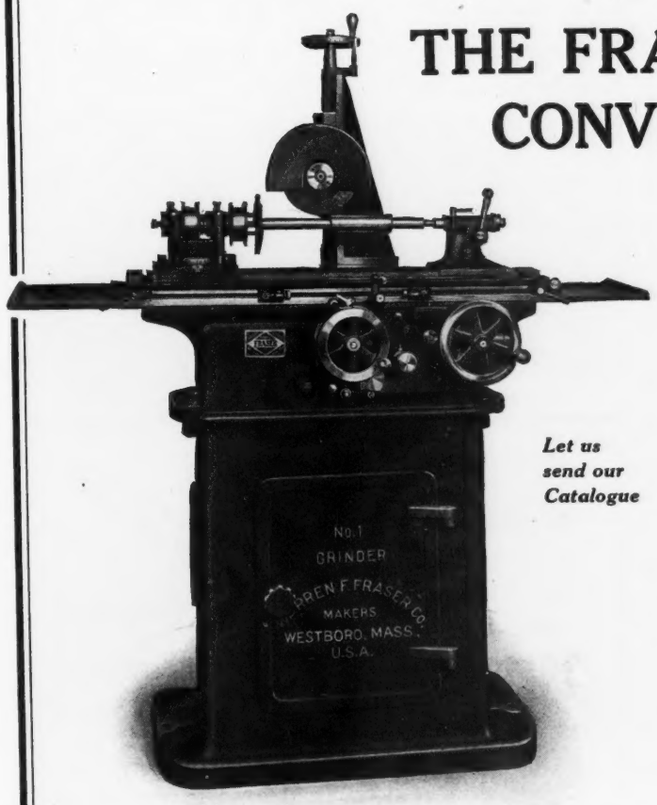
## THE FISCHER
### Profile Grinding Machine

Follows the master gage absolutely, automatically providing the required amount of clearance. Performs with positive uniformity, affording the quickest and most economical means of producing exact duplicates at any time.

**FISCHER MACHINE CO.**
**PHILADELPHIA PA.**

DOMESTIC AGENTS: Chas. A. Strelinger Co., Detroit, Mich. FOREIGN AGENTS: Coats Machine Tool Co., Ltd., Thanet House, Strand, London, Glasgow and Newcastle-on-Tyne. Aux-Forges de Vulcain, Paris, France. Yamatake & Co., Tokyo, Japan. Henry Coe & Clerici, Milan, Italy. Allied Mchy. Co., Spain, Portugal and Switzerland. Ateliers Demoor, Belgium. Chr. A. Herstad, Norway, Sweden, Denmark and Finland.

## THE FRASER UNIVERSAL CONVERTIBLE GRINDER




*Let us send our Catalogue*

A practical, modern machine, built to meet the exacting requirements of fine tool grinding and valuable for production work within its range.

The cut shows the Fraser Universal as a combination cylindrical and surface grinder—a unique arrangement which enables it to handle surface work up to 6″ by 20″ by 8″ in height and cylindrical work up to 8″ by 20″.

An accurate machine for discriminating manufacturers of high-grade tools.

**THE WARREN F. FRASER CO.**

Factory and General Offices
**WESTBORO, MASS., U. S. A.**

*Boston Branch,* **201 Devonshire St.**

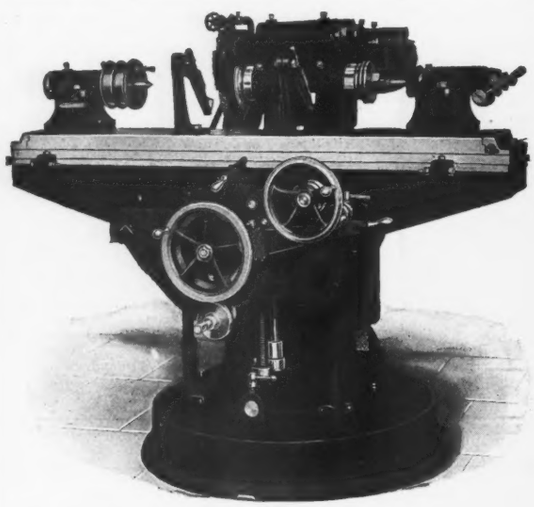
# Grinding Wheels with a Reputation

STERLING — "THE STERLING" PAT. APR. 10 1883 — GRINDING WHEEL CO.

Sterling Wheels are standard in all kinds of shops in all parts of the country. They have a reputation based on performances—fast, cool cutting, economical and uniformly dependable. Sterling Wheels are profitable producers. Ask our customers. Catalog?

**THE STERLING GRINDING WHEEL CO.**

Factories and Offices, Tiffin, Ohio. Selling Agency: L. Best Company, 75 Barclay St., New York. Chicago Store: 30 North Clinton St.



## The Thompson Universal Grinding Machine

is an entire grinding department in itself. A rigid, convenient, wide range machine that will handle all the work that comes up in the average shop. *Send for Bulletin No. 12.*

**THE THOMPSON GRINDER CO.**
SPRINGFIELD OHIO, U.S.A.

# DIAMOND TOOLS

FOR TRUEING GRINDING WHEELS

QUALITY SERVICE SATISFACTION

INDUSTRIAL GEMS

**THE DESMOND-STEPHAN MFG. CO.**
URBANA, OHIO

SPECIALISTS IN GRINDING WHEEL DRESSERS

MANUFACTURERS OF

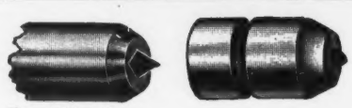
DIAMO — CARBO HUNTINGTON
MAGAZINE SHERMAN

# Waterbury

A good grinder at an equitable price. A modern machine, convenient, accurate and durable, to handle a wide range of tool room, die, and surface grinding.

*Write for the details.*

**The BLAKE & JOHNSON CO.**
WATERBURY, CONN., U.S.A.



"End View"

## For Truing Grinding Wheels

Francis Diamond Hand and Grinder Tools always give entire satisfaction. The diamonds in these tools are of the hardest and best quality and set very securely.

Length of Hand Tool shown here, 11½ in. over all. Rosewood handle. Let us send you an assortment for selection.

**FRANCIS & CO.**
50 STATE ST., HARTFORD, CONN., U.S.A.

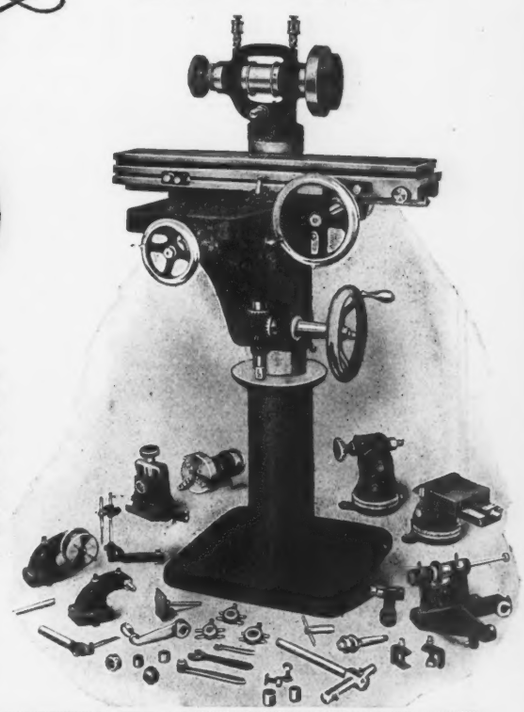
Established in 1799 First National Bank Bldg.

For Thoroughness

# The Greenfield

TRADE MARK REG. U.S. PATENT OFFICE

Universal Grinder



A machine more complete than the Greenfield Universal Grinder would be hard to find. It will perform *all* your tool grinding—straight, taper and rose reamers; flutes of taps, tapered arbors, flat keys, gauges, flat bar work, slitting saws, small internal work, countersinks and counterbores; spur, bevel, spiral, formed, and end milling cutters; angular, small end, gear, convex and inserted tooth cutters. Spindle turns in large bronze bearings without vibration. Head is a solid casting. Send for complete description.

**The Greenfield Machine Co.**
GREENFIELD MASSACHUSETTS

# REID No. 2 SURFACE GRINDER

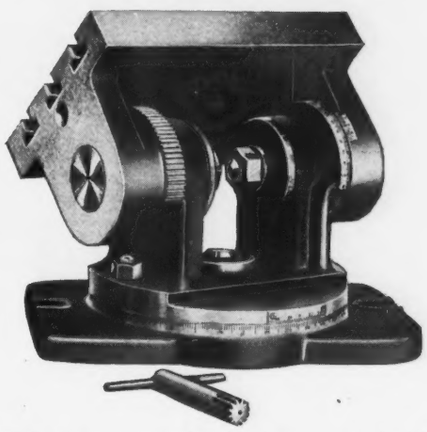
*Study the details of this Grinder*

*Ask for booklet*

Accuracy and ease of control are the two outstanding features in the Reid Surface Grinder. For both tool room and factory; it facilitates the attainment of close limits without sacrificing production.

Starting and stopping are controlled instantaneously by a push rod operating from center of hand wheel. Cross feed is obtained at end of each stroke or at reversing points as desired.

# REID UNIVERSAL ANGLE FIXTURE



*Get the facts on this fixture*

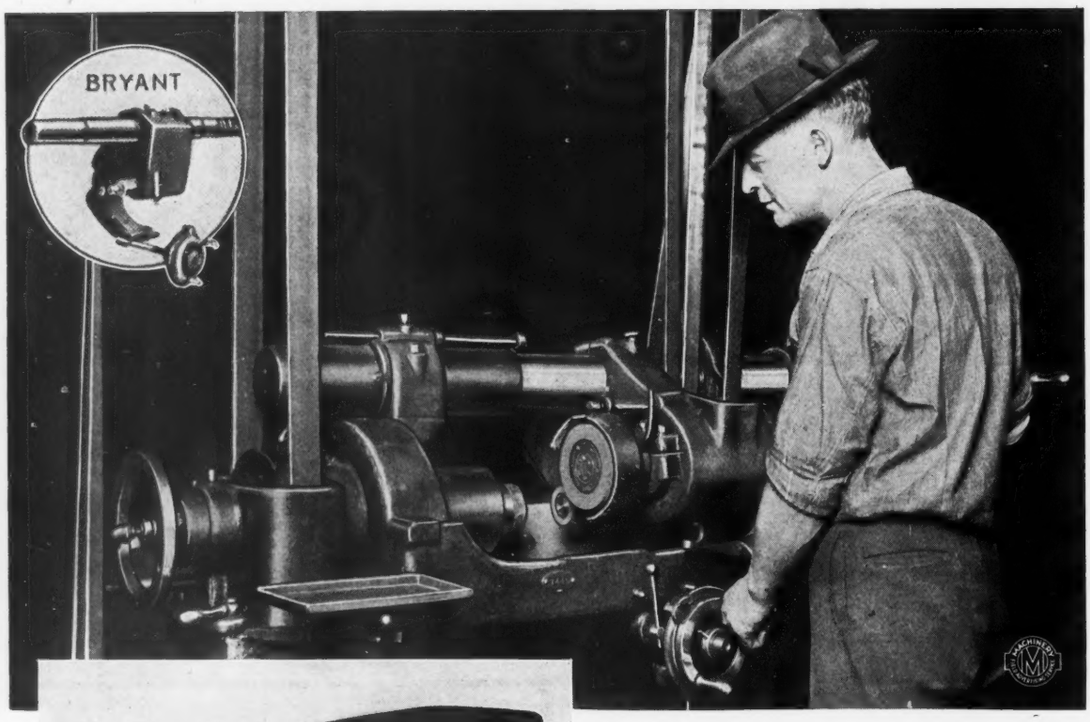
*Write for circular*

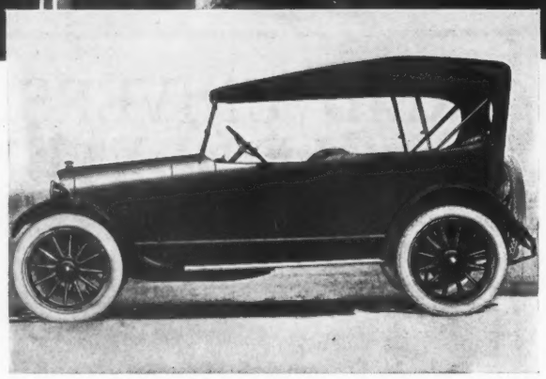
This fixture swivels 360 degrees in the horizontal, and 180 degrees in the vertical plane. Ordinary adjustments can be made to $\frac{1}{12}$ of a degree by the double vernier. For finer adjustments a sine bar attachment is provided. The Universal Angle Fixture can be usefully employed on drilling, milling, planing, shaping and grinding machines, and is invaluable for die sinking, tool and experimental work. Made in three sizes: 6" x 9", 8" x 12" and 12" x 18".

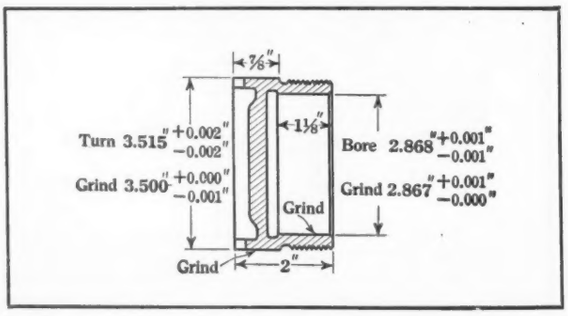
**REID BROTHERS CO., Inc.**
BEVERLY, MASS., U. S. A.

ENGLISH AGENTS:
Oliver Mchy. Co., Ltd., 201-203 Deansgate, Manchester, Eng.

# THE BRYANT
## Chucking Grinder






## Here's an Interesting Time Study in Automobile Production

Before the Bryant Chucking Grinder was used for grinding interior and exterior of these case-hardened transmission bearing sleeves for the Reo car, production was 80 per 10-hour day. When the Bryant was put on the job, production jumped to 120—and the total tolerance is only 0.001″ on both diameters.

Multiply the difference by nine, and you'll understand how Bryant Chucking Grinders are helping in the Reo plant to maintain the high efficiency in production this industry established. *Most* automobile manufacturers use the Bryant Chucking Grinder. It is the logical machine for hard and soft, inside and outside grinding on chucked work.

***We'll be glad to send further details***

## BRYANT CHUCKING GRINDER CO.
**SPRINGFIELD** **VERMONT, U. S. A.**

Detroit Office: 67 Shelby St. Chicago, Direct Representative, 1352 Bryn Mawr Ave. Motch & Merryweather Mchy. Co., Agents in Cleveland, Cincinnati and Pittsburgh. Henry Prentiss & Company, Agents in New York City, Boston, Rochester, Syracuse, Buffalo and Scranton. Berger & Carter Co., Agents in San Francisco and Los Angeles.

# DIAMOND
## Disc Grinding

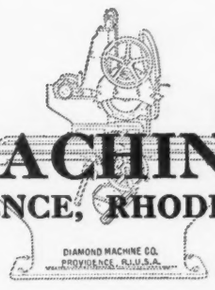
### Performs a Wide Variety of Work to Best Possible Advantage

EQUIPPED with an 18″ disc and a 14″ ring wheel, this No. 6 Diamond Disc Grinder has turned out a great quantity and variety of work during the two years it has been installed at the Premier Machine Tool Works, Albany, N. Y.

A number of simple fixtures facilitate rapid handling of special work and certain jobs of radial grinding are finished on the ring wheel to much better advantage than they could be handled by any other method.

When photographed, the man at the ring wheel was surfacing the bases and cleaning up a lot of cast iron countershaft hangers, while the disc wheel was being used for a fine finishing job.

*A two operation machine is always a time saver—and Diamond Disc Grinding has other advantages also.*




*Send for the catalog and production data. Size up Diamond Grinders in connection with your work.*

## DIAMOND MACHINE COMPANY
**PROVIDENCE, RHODE ISLAND**

# THOMSON SPOT WELDERS

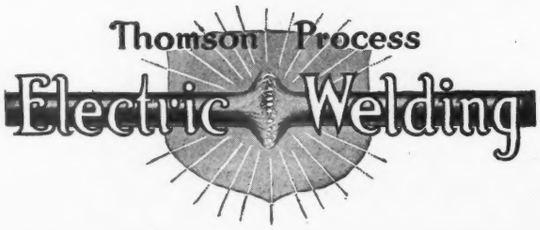
Will replace your rivets, punches, hammers, etc., on light sheet metal work. Not only this but productions are trebled and at less cost. The pieces to be welded are placed between the copper die points, a foot treadle depressed and a weld made that will hold permanently. Why such strength? Because none of the metal is removed as in the punching process when riveting. No smoke, dirt, glare or danger. The Thomson is always the choice of the wide-awake production man. Why? Because of quality, reliability and efficiency.

Ask for Bulletin SA-2.

## Thomson Spot Welder Company

**LYNN, MASS., U. S. A.**

BUFFALO.....595 Ellicott Square Building
CHICAGO.....817 W. Washington Blvd.
CINCINNATI...Knowlton & Langland Streets
DETROIT.....1133 Majestic Building
DULUTH.....Northern Machinery Company
GRAND RAPIDS.....McMullen Machinery Co.
KANSAS CITY.....English Tool & Supply Co.
LYNN.....161 Pleasant Street
MINNEAPOLIS.....Northern Machinery Co.
NEW YORK.....1604 U. S. Express Bldg.
PITTSBURGH.....3 Wood Street
SAN FRANCISCO...Chas. A. Dowd Sales Co.
ST. LOUIS.....400 Security Building




# THOMSON BUTT WELDERS

All over the country are daily butt welding automobile rims by the thousand, as well as many other classes of work where quantity and quality production stand foremost. The operating cost on small work is so negligible as to figure the welds at so many cents per thousand.

Thomson Butt Welders have been on the market over twenty-five years, and are still in operation. It takes Thomson Quality to do this.

Ask for Bulletin BA-2.

## Thomson Electric Welding Company

**LYNN, MASS., U. S. A.**

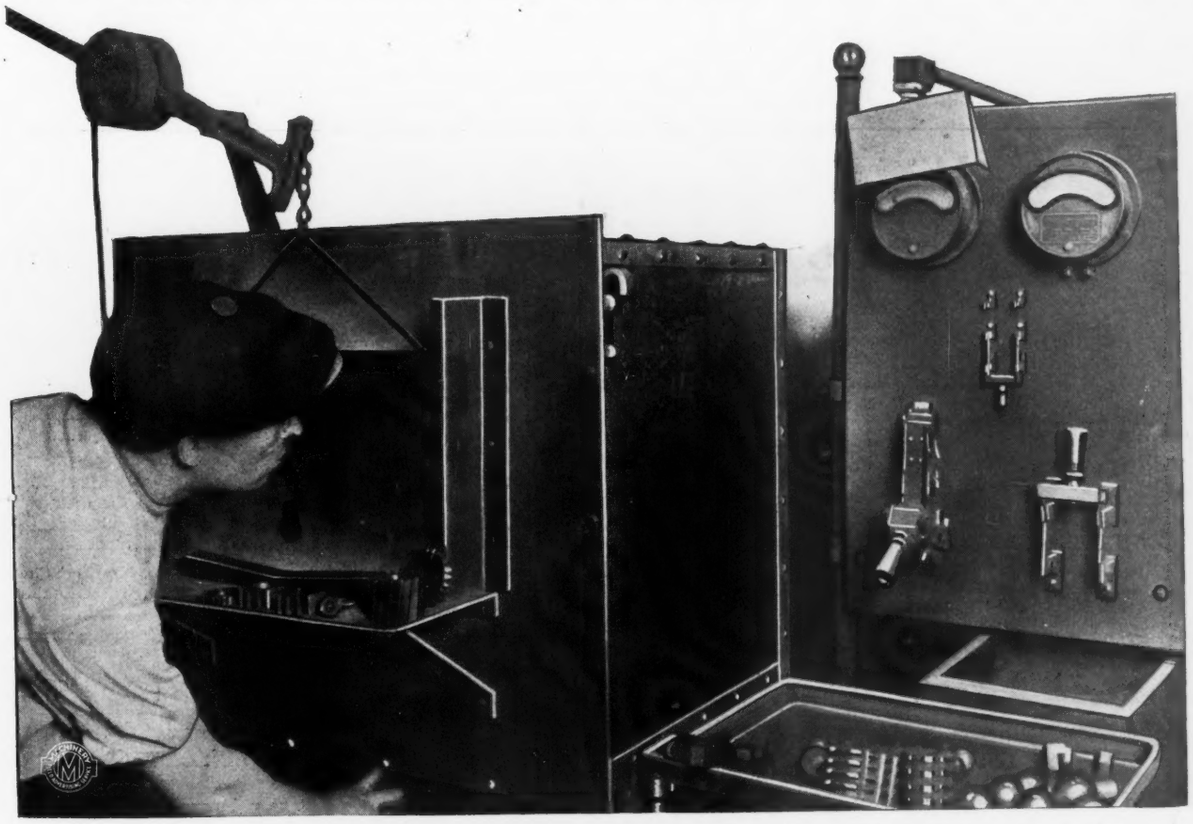
BUFFALO.....595 Ellicott Square Building
CHICAGO.....817 W. Washington Blvd.
CINCINNATI...Knowlton & Langland Streets
DETROIT.....1133 Majestic Building
DULUTH.....Northern Machinery Company
GRAND RAPIDS.....McMullen Machinery Co.
KANSAS CITY.....English Tool & Supply Co.
LYNN.....161 Pleasant Street
MINNEAPOLIS.....Northern Machinery Co.
NEW YORK.....1604 U. S. Express Bldg.
PITTSBURGH.....3 Wood Street
SAN FRANCISCO...Chas. A. Dowd Sales Co.
ST. LOUIS.....400 Security Building

HOSKINS
TRADE MARK REGISTERED

# Electric Furnaces Used Throughout

Shown in the photograph is a corner in the Hardening Department of the Timken-Detroit Axle Co., Detroit, Mich.—all Hoskins equipment. This Hoskins Type F. C. Electric Furnace has been running between ten and twelve hours per day for some three years hardening cutters, drills, lathe tools and similar pieces requiring a temperature of 2,000° F. or over. Excellent results are obtained because of the very close control of the temperature, and of the atmosphere in the heating chamber. The Hoskins Pyrometer on the switchboard guards the temperature of the furnaces. Timken products come through in such large lots that heat treating must be done on a quantity basis. With this in mind, it is a significant fact that the staff of experts maintained by this well-known company should have unanimously decided upon Hoskins equipment. Write for Catalogs 8-M and 101.

**A Corner in the Hardening Department of The Timken-Detroit Axle Co.**



HOSKINS MANUFACTURING CO.
DETROIT, MICH. U.S.A.

DETROIT BOSTON CHICAGO PITTSBURGH NEW YORK

# AMERICAN GAS FURNACES

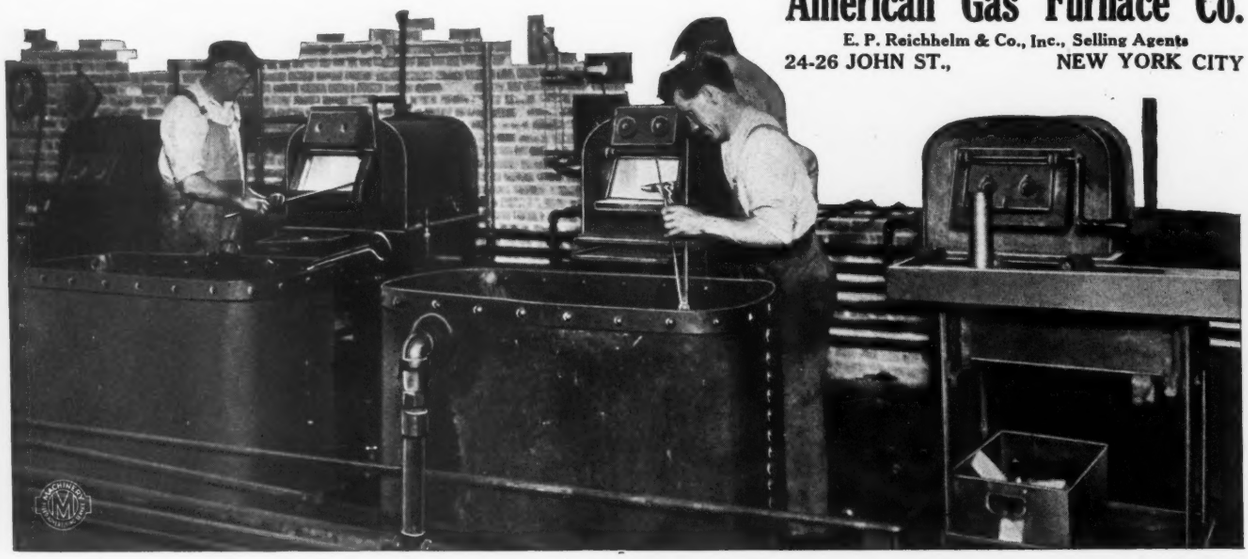
## Sixteen Good Reasons for Efficiency of "Barber-Colman" Products

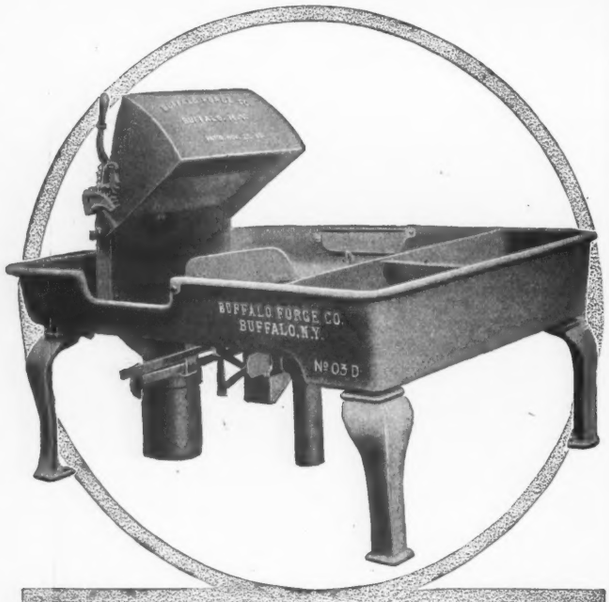
You can't disassociate "Barber-Colman" Hobs from the organization back of them. Men, equipment and materials are all of the very best in the "Barber-Colman" plant, out in Rockford, Ill. Durability and long life between grinds are among the outstanding features of these notably fine tools, and as heat treatment is an important factor in this connection, the makers give their American Gas Furnace outfit the lion's share of the credit.

They like the even temperature, uniform control and convenience of American Gas Furnaces as well as the small amount of fuel consumed, the durability of the fire brick, cleanliness and other economical features. You too will appreciate the distinctive advantages of American Gas Furnaces when you apply them to your heat treating problems.

**American Gas Furnace Co.**

E. P. Reichhelm & Co., Inc., Selling Agents
24-26 JOHN ST., NEW YORK CITY






**Buffalo Heavy Duty Forges**

Buffalo Forges are designed for the particular work they are required to do. Our Catalogs 100 and 108-51 describe our full line. Write for them.

**BUFFALO FORGECO.** BUFFALO NEW YORK
New York, Chicago, Pittsburgh, St. Louis.

**Gas—INDUSTRIAL—Oil FURNACES**

MINIMUM SCALING OF WORK
MINIMUM FUEL COST

are possible only by using the Surface Combustion Patented Automatic Air-Gas Proportioner—a one-valve control—which is a part of all our industrial furnaces.

Shall one of our engineers call on you and tell you why many of the largest tool manufacturers are using Surface Combustion Furnaces?

**THE SURFACE COMBUSTION CO.**

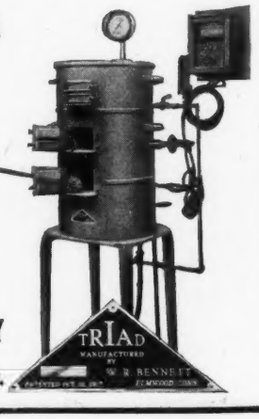
*Industrial Furnace Engineers and Manufacturers*

General Office and Works: 366-368 Gerard Ave., Bronx, New York City
PHILADELPHIA PITTSBURGH CHICAGO

**Get the Combination**

Hardening, Preheating and Tempering may be performed simultaneously in the Triad Combination Furnace. One heat supplies the three chambers. Saves time, money, space and labor—minimizes danger of oxidation in transferring work.

Send for Catalog No. 1.




**THE W. R. BENNETT COMPANY**
P. O. Drawer 666
ELMWOOD CONN.

# Krantz Safety Auto-Lock Switch

Krantz Auto-Lock Switch
with Cover Locked in Closed Position

W
WESTINGHOUSE ELECTRIC

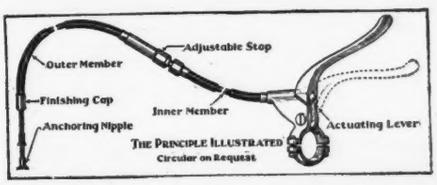
The Krantz Safety Auto-Lock Switch is not an adapted knife switch but a real safety switch, double break and quick break. The use of this device eliminates the human element. Serious and fatal accidents occur daily from unprotected switches.

The switch is quick-break, double-break, non-retarding and is mounted in a 12-gauge iron box. When the switch box is open, all accessible parts are absolutely dead.

The box cannot be opened without first throwing the switch in the "off" position. Fuses cannot be blown except when the box is closed, and they cannot be replaced except when all clips and all accessible parts are dead.

Switch may be locked in the "off" position by placing a padlock in the handle, thus preventing the closing of the circuit by unauthorized persons. A padlock may be placed also on the door over the fuses to prevent the removing or replacing of fuses.

**WESTINGHOUSE ELECTRIC & MANUFACTURING CO.**
**EAST PITTSBURGH, PA.**

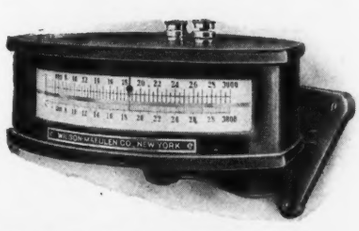



# BOWDEN WIRE MECHANISM

Adopted for Controls on Mechanical Devices
Where a Short Back and Forth Motion is Required

**THE GWILLIAM COMPANY**
**ENGINEERS**
253 West 58th Street, (at Broadway) NEW YORK

# PYROMETERS



High Resistance

Multi-Record Autographic

**WILSON-MAEULEN CO., Makers**
NEW YORK: Factory and Office, 784 East 142d St.
CHICAGO: Sales and Service Office, Monroe Bldg.
DETROIT: S. & S. Office, Dime Bank Building.

# For Effective Economical CASE HARDENING

## Supplants the Dangerous Cyanide

**Why?** Ferro Case gives a cleaner, deeper case than cyanide. It has no poisonous fumes. The first cost is less than cyanide and as Ferro Case does not deteriorate with age or climatic conditions it can be stocked in quantity. Ferro Case M for use in cyanide melting furnaces.

Ferro Case S for sprinkling on hot steel. Ask us about them.

**C. G. Buchanan Chemical Co.**
Sta. H., Cincinnati, Ohio, U. S. A.

# The Unfailing Counsel on Heat treating

## Looks You Straight in the Eye and Tells the Whole Truth About Temperatures

WHERE a needle swing of fifteen degrees spoils a heat and puts hundreds of dollars on the Loss side of your ledger, there's where Pyrometer accuracy counts.

With such accuracy guaranteed, and on top of this, a ruggedness and substantial design that appeals as quickly as the massive symmetry of a well designed machine tool or the stream lines of a powerful motor car, Brown Pyrometers today stand on bed rock. Call together the largest pyrometer user army in the world and refer to any one of the satisfied fourteen thousand for anything you may want to know about Brown Pyrometer dependability.

No wonder Brown's look you straight in the eye—fearless as cold steel, honest as Lincoln. It's up to you to watch the dollars and cents leaks through misrepresented temperature for a bigger business or a better job. Do this by getting complete information as to what Brown Pyrometers save.

Write today.

**The Brown Instrument Co.**
**Philadelphia**

*The world's largest Pyrometer makers.*

New York Pittsburgh Chicago
Detroit St. Louis

# Brown Pyrometers

## Reliable Speedometers Demand Reliable Pyrometers

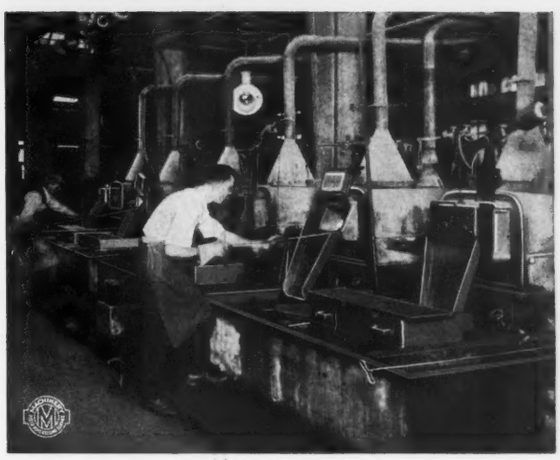
The Stewart-Warner Speedometer Corporation, Chicago, manufacturer of the well-known Stewart Speedometer, uses three *Tycos* Pyrometers in its hardening department. The first *Tycos* Pyrometer was installed more than six years ago—its satisfactory service sold the other two.

The upper illustration shows one of these *Tycos* Pyrometers used in controlling the temperatures of the six furnaces shown in the lower photograph. In these furnaces drive gears, driven shafts, etc., for the Stewart Speedometer are hardened.

The hardening department foreman endorses the *Tycos* Pyrometer as "accurate—entirely satisfactory."

Seventy years' experience in the manufacture of temperature controlling and recording instruments ought to make an impression on the mind of the practical investigator.

Write *now* for bulletins. They may be your protection of a future job.



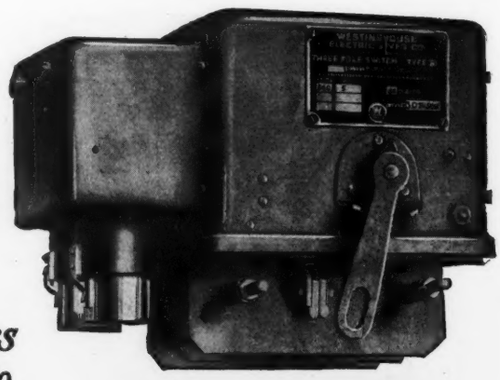
*There's a Tycos Temperature Instrument for every purpose.*

REG. U.S. PAT. OFF. Tycos ROCHESTER, N.Y.

*Taylor Instrument Companies*
ROCHESTER NEW YORK

453

# -And Now The Type 815-



*Starting Switch for Squirrel Cage Motors from one-half to 10 Horsepower*

Now that this switch is available at moderate cost, you will not need to worry along with the drawbacks of the old knife switch.

What Type 815 does—

**—Protects the motor against overloads.**

**—Protects both man and equipment against accidental starting of motor should power unexpectedly return.**

**—Lowers the fire risk.**

**—Helps to lower maintenance cost.**

*Quick Make and Break*—When once started in either opening or closing direction, action of contacts is automatic and instantaneous, and cannot be stopped or retarded.

*Rolling Contacts*—Arcing is confined to the tips of contacts. The rolling action of contacts prevents roughing or pitting of the contacts seats. A strong spring holds contacts firmly in closed position.

*Current Carrying Parts Enclosed*—This precautionary measure safeguards the employee.

*Conduit or Open Wiring*—Knockout holes at top, and back.

*Accidental Starting of Motor Prevented*—Hand reset protects workman and equipment against accidental starting of the motor.

*Rid of the Oil Nuisance*—Switch fitted with asbestos-lined tank and asbestos barriers so that oil need be used only when presence of explosive gases make it necessary.

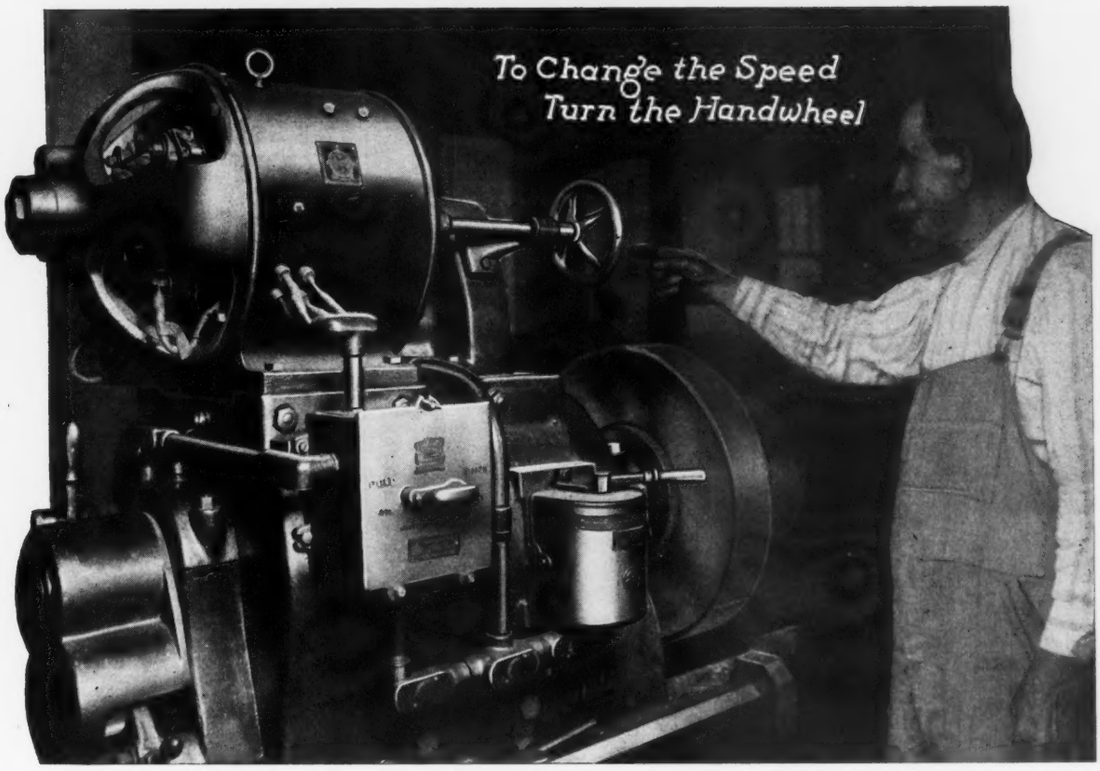
***Ask for Descriptive Leaflet 1441 A***

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
East Pittsburgh, Pa.

W
WESTINGHOUSE ELECTRIC

# Westinghouse

# Type A-S Adjustable Speed RELIANCE MOTORS




## *"Belts are a nuisance"*

The words quoted above summarize the conclusion reached some time ago in the Cleveland plant of one of the biggest builders of turret and screw machines in the country. The first thing that strikes the visitor to this plant is the absence of overhead belts and shafting, and the efficient appearance of the equipment. Forty Reliance Motors are on the job. Big lathes, boring mills, thread milling machines, gear generators, milling machines and planers are driven by Reliance Motors.

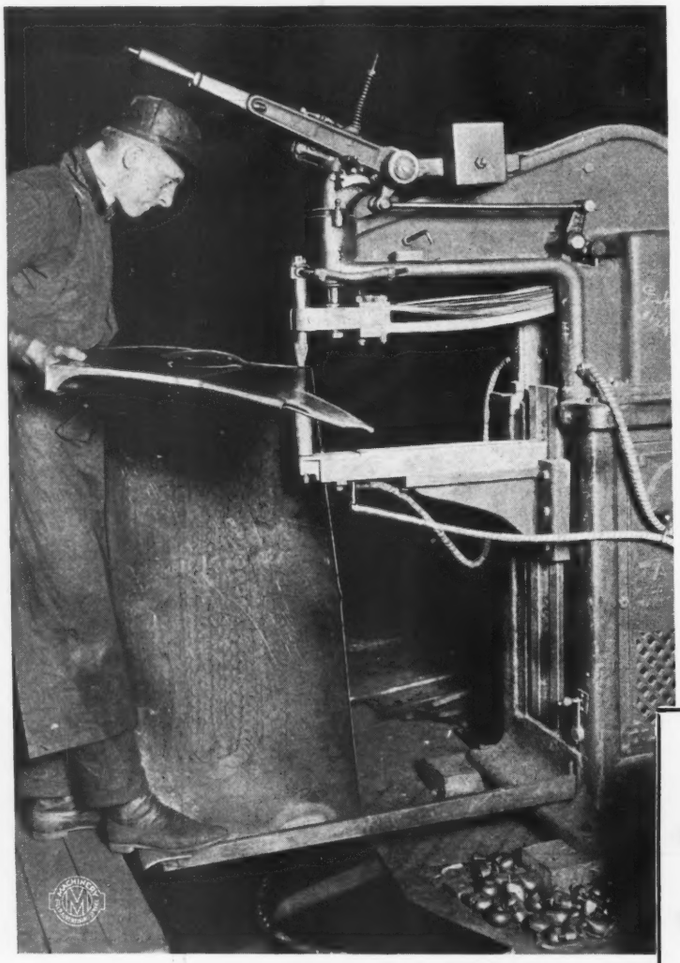
Type A-S Reliance Motors mean more than the usual advantages of clear overhead, better light, and cleanliness, flexible machine arrangement, and positive drives without belts to slip and break. They eliminate the dangerous and time-wasting shifting of belts. It is so easy and convenient for the operator to change the speed that he keeps his machine speed at the highest practicable point. This helps production.

***For details get Bulletin 1014***

## Reliance Electric & Engineering Co.

**1056 IVANHOE ROAD** Branches: Boston, New York, Chicago, Philadelpia, Pittsburgh **CLEVELAND, OHIO**

# Taylor Spot Welders

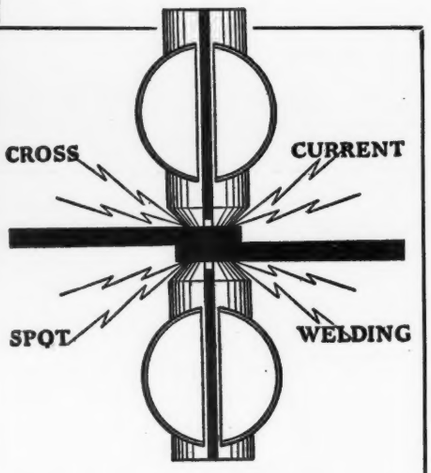


## Taylor Welding Automobile Bodies

THERE are five Taylor Welders in operation in the several plants in the Wilson Body Corporation of Detroit. The first of them was installed about two years ago. The letters of recommendation were repeat orders.

The operators use these machines regularly nine hours every day. During a rush, operation is continual, often for long periods.

Taylor Welders are used for connecting the various parts of automobile bodies. Material is steel, gauges varying from No. 12 to No. 22. Number of welds per body differs, of course, according to type. In all cases, however, Taylor Welders have functioned to the entire satisfaction of the company.

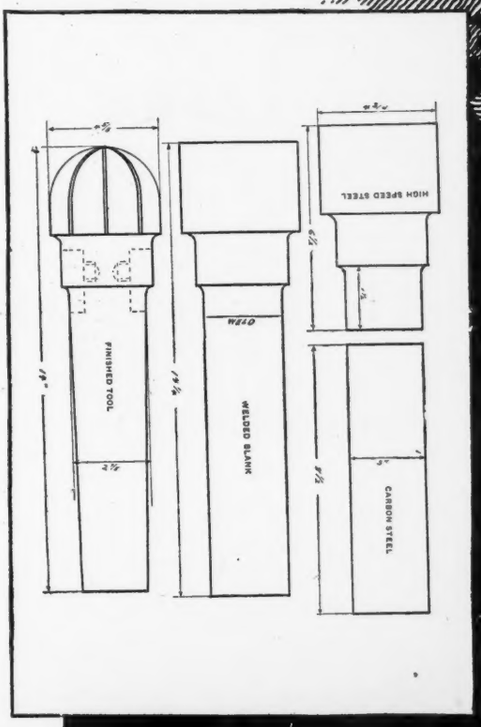



Under the Taylor Process of Cross Current Spot Welding two separate currents are caused to flow in bias directions through the material to be welded. A better heat concentration is thus possible, which reduces the time required for welding and consequently the current consumption. The booklet gives complete details. Get a copy.

## THE TAYLOR WELDER COMPANY

**WARREN, OHIO, U. S. A.**

# SAVE YOUR $




HIGH SPEED STEEL

WELD

TOOL STEEL

EWCo

## FREE

### ONE HIGH-SPEED STEEL TOOL

Mail us one of your old High Speed Steel Butts, which has become too short to use in the regular way, any size from ½ x 1″ up to ¾ x 1½″, or a round tool of equal area, specifying the overall length wanted, and we will furnish the shank and do the welding free of charge, and return to you ready to forge or machine.

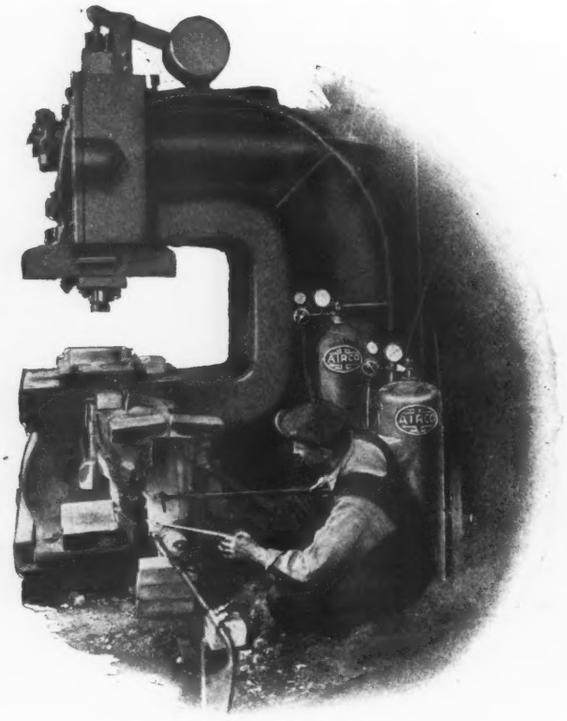
***You Have Nothing to Lose—***
***Much to Gain***

*Write for Catalogue and full particulars.*

## "ELWELD"

**THE ELECTRIC WELDING CO.**

**SUPERIOR VIADUCT** **CLEVELAND, OHIO**



*It may be a job like this, involving repair, or it may be an operation of manufacture—in either case Airco Service will help the welder cut time and costs to the lowest degree.*

AIRCO

# SERVICE

IS RELIABLE—INSURING AT ALL TIMES AMPLE AND CONSTANT SUPPLIES OF

# OXYGEN
AND
# ACETYLENE

## AIR REDUCTION COMPANY, INCORPORATED

**120 Broadway, New York City**

*Airco Products*

*OXYGEN—Nitrogen—Calcium Carbide—Acetylene Generators—ACETYLENE*

*Welding and Cutting Apparatus and Supplies.*

PLANTS AND WAREHOUSES

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BRIDGEPORT, CONN.
BRONX, N. Y.
BROOKLYN, N. Y.
BUFFALO, N. Y.
CAMDEN, N. J.
CHICAGO, ILL.
CINCINNATI, O.
CLEVELAND, O.
COATESVILLE, PA.
COLUMBUS, O.
DEFIANCE, O.
DES MOINES, IOWA
DETROIT, MICH.
DORCHESTER, MASS.
DULUTH, MINN.
EAST ST. LOUIS, ILL.
EMERYVILLE, CALIF.
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GRAND RAPIDS, MICH.
INDIANAPOLIS, IND.
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SEATTLE, WASH.
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SO. BETHLEHEM, PA.
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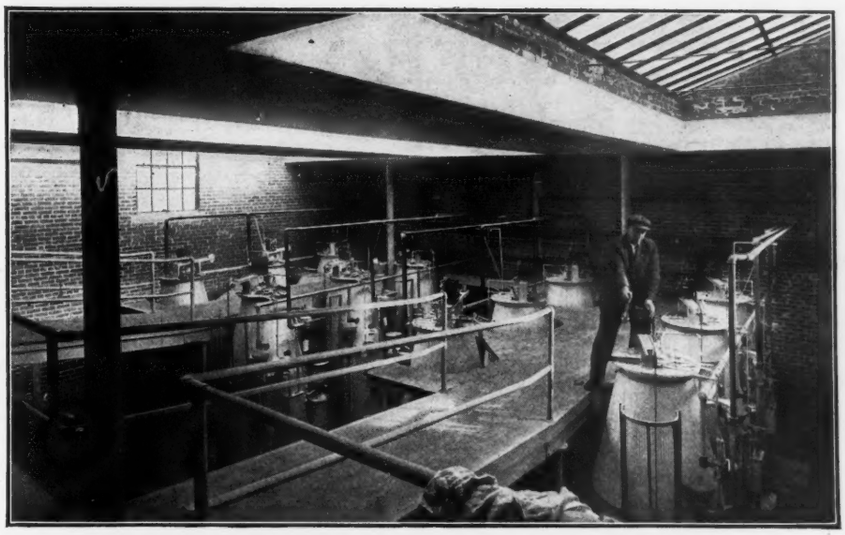
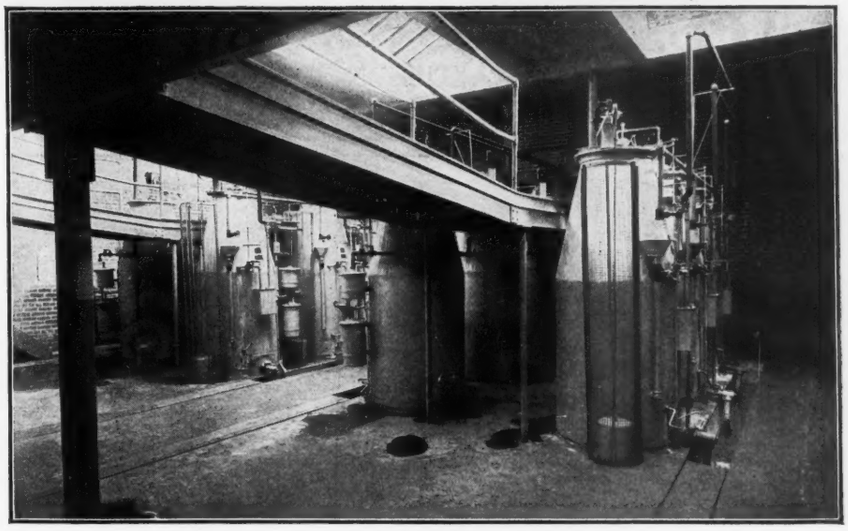
SPRINGFIELD, O.
ST. LOUIS, MO.
TACOMA, WASH.
TOLEDO, O.
VENICE, ILL.
WARREN, O.

# Acetylene Production for Welding



A model installation of twelve 300-lb. Davis-Bournonville Acetylene Pressure Generators which furnished gas for 300 welders on Liberty Motor Cylinders.



"When the Lincoln Motor Co. began the welding of cylinders, their equipment consisted of two 300-lb. Davis-Bournonville generators with a capacity of 600 cu. ft. per hour. After six months of increasing production, the generator room was equipped with twelve 300-lb. Davis-Bournonville generators with a capacity of 3600 cu. ft. per hour, making what is considered the largest equipment of generators in the world."*

—American Machinist, May 29, 1919.

*This was one of the largest commercial installations, but the U. S. Government ordered 64 300-lb. Davis-Bournonville generators for a single purpose in the Chemical Warfare Section.

## DAVIS-BOURNONVILLE CO.

WELDING AND CUTTING DAVIS APPARATUS DAVIS-BOURNONVILLE CO. N.Y.

**General Offices: JERSEY CITY, N. J.**

Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Jersey City, Los Angeles, Minneapolis, Montreal, Philadelphia, Pittsburgh, St. Louis, San Francisco, Seattle, Toronto

**Factories at Jersey City, N. J., Elkhart, Indiana, Niagara Falls, Ontario**

# SASCO

## HIGH SPEED STEEL

**"The Steel which Sets the Standard"**

One large manufacturer, turning cast iron, put SASCO High Speed Steel in competition with several different high speed steels at the following rate:

| | |
|---|---|
| Surface feet per minute | 90 |
| Depth of cut | 1/16 |
| Feed per revolution | .024 |
| Average number of pieces per grind, SASCO | 30 |
| Average number of pieces per grind nearest competitor | 20 |

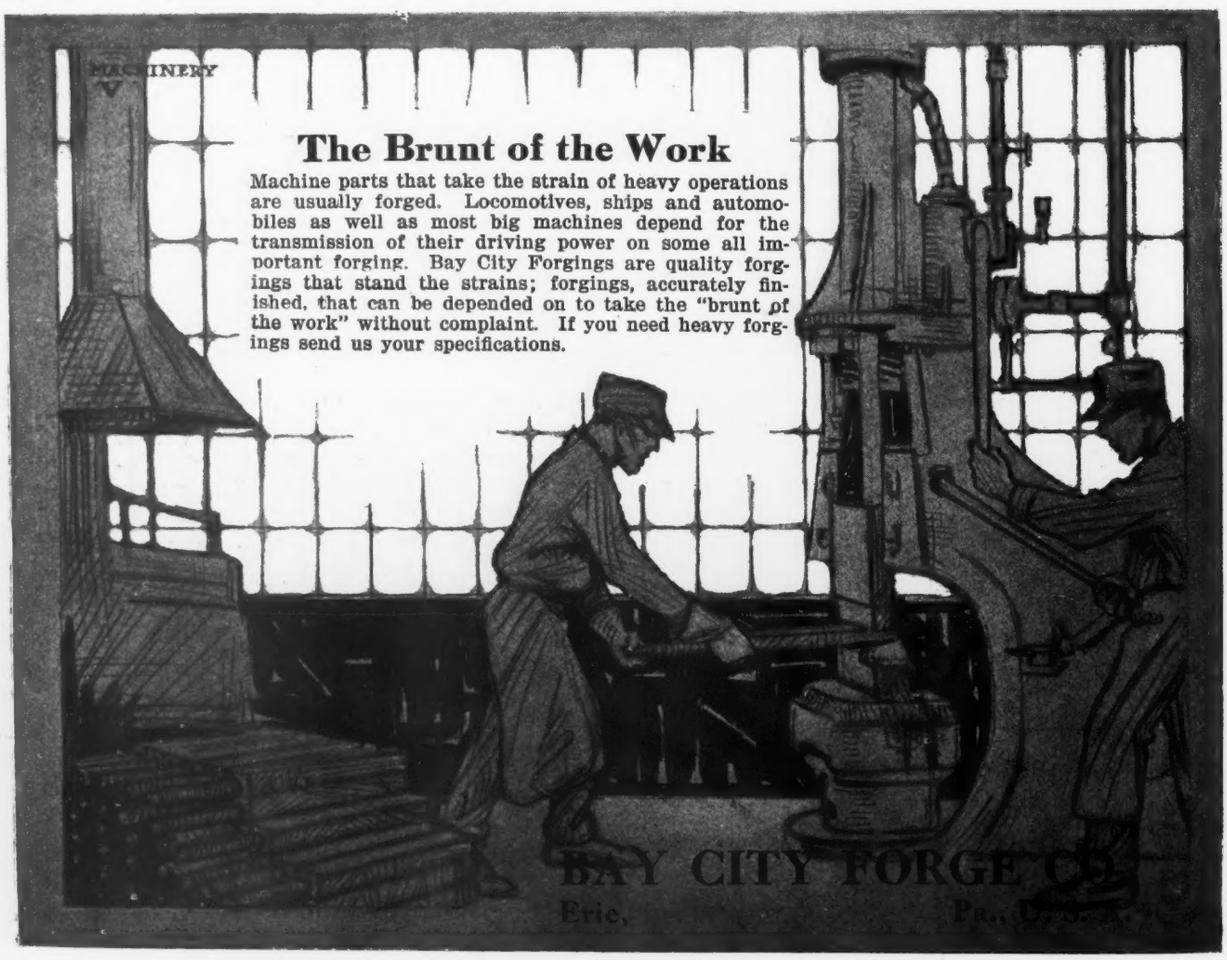
**CAN YOU OBTAIN THIS RATE OF PRODUCTION?**

If not, write to

**SYRACUSE ALLOY STEEL CO., Inc.**

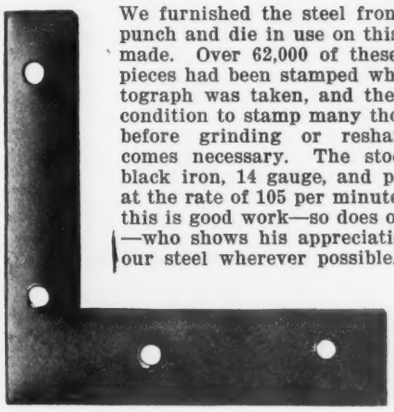
SYRACUSE, N. Y.





# OUR STEELS

## JUSTIFY THEIR CHOICE FOR PUNCHES *and* DIES



We furnished the steel from which the punch and die in use on this press were made. Over 62,000 of these black iron pieces had been stamped when this photograph was taken, and the dies are in condition to stamp many thousand more before grinding or resharpening becomes necessary. The stock is tough black iron, 14 gauge, and production is at the rate of 105 per minute. We think this is good work—so does our customer—who shows his appreciation by using our steel wherever possible.

*Have you tried them in your work?*

**ABORN STEEL CO., Inc.**

26 CLARKE STREET, NEW YORK, N. Y., U. S. A.

Century Crucible Steel Works
Ontario Electric Steel Works

BOSTON, MASS. . . . . 171 High Street
BUFFALO, N. Y. . . . . 520 Marine Trust Bldg.
PHILADELPHIA, PA. . . . . 269 Drexel Building
ROCHESTER, N. Y. . . . . 133 Andrews Street
SAN FRANCISCO, CAL.

# THREE MILLION BLANKS FROM THIS "KETOS" DIE

This figure is just a rough estimate, for the die is still on the job, but it regularly turns out 40,000 blanks between grinds and as only 1/64" of metal is removed at each grinding, it is safe to assume that it will go well over the top before being scrapped. This is nothing unusual for a "Ketos" Die in the Holtzer-Cabot Electric Plant, Jamaica Plains, Mass., where "Ketos" is used exclusively for punches and dies. Many manufacturers find it equally satisfactory for taps, reamers, cutters, etc. Try it in *your* toolroom.

*Steel of Every Description*

**Hawkridge Brothers Co.**

303 Congress Street
BOSTON MASS., U. S. A.

# A Combination that insures Satisfaction in Drop Forge Work

**Hammond XX Trimmer**
FOR HOT WORK

**Phoenix Extra Tool Steel**
FOR SHEAR BLADES

**Hammond Standard Trimmer Tool Steel**
FOR COLD OPERATIONS

*Use these in connection with* ***Hammond Die Blocks***

## The Hammond Steel Company, Inc.

Syracuse, N. Y.

Cleveland Office: 217 Engineers Bldg.
Detroit Office: 1257 David Whitney Bldg.
Buffalo Office: 792 Ellicott Square
New York Office: 312 Hudson Terminal

*An Honest, Reliable Test of*

# URANIUM

## STEEL *for* TOOLS

U represents Uranium Steel Tools; A high speed tools of standard quality. Uranium tools were ½" x 1½"; standard tools were of larger sizes.

**TEST No. 3—CUTTING LOCOMOTIVE CRANK PINS**

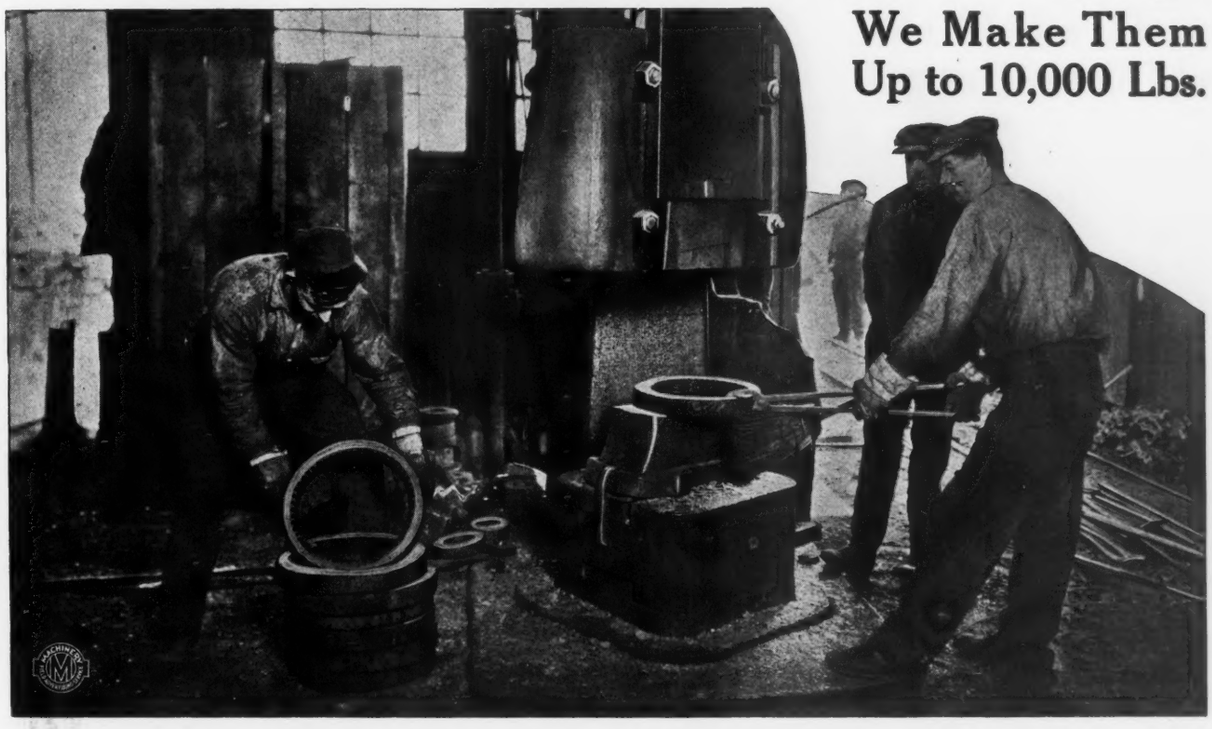
| Tool | Feed Ins. | Speed | Depth Ins. | Remarks |
|---|---|---|---|---|
| U | 1/16 | 74 | 5/8 | Ran 12 inches before regrinding. |
| A | 1/16 | 74 | 5/8 | Ran 2 inches before regrinding. |
| U | 1/16 | 64 | 5/8 | Ran 2 inches before regrinding. |
| A | 1/16 | 64 | 5/8 | Ran 8 inches before regrinding. |

*If your dealer cannot supply you, write direct to us.*

**STANDARD ALLOYS COMPANY**
FORBES & MEYRAN AVES. PITTSBURGH

# There's An Increasing Demand For Forgings

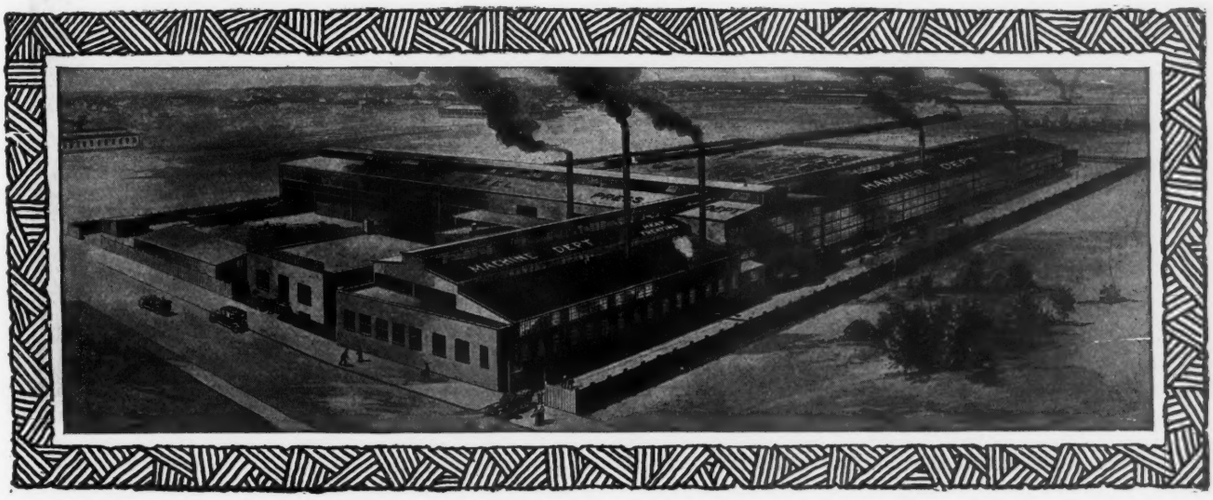
## We Make Them Up to 10,000 Lbs.



The use of forgings is increasing—experience has demonstrated their suitability for a broad range of work. In developing internal gear drives, for example, up-to-date practice demands blanks forged from good carbon or alloy steel. A large share of this business comes to us, which is not surprising in view of the completeness of our equipment and our reputation for matching the method to the job. Let us estimate on your forgings for heavy duty parts.

# THE CRUCIBLE STEEL FORGE COMPANY

**6603 Grant Ave., S. E.** **Cleveland, Ohio, U. S. A.**



Reg'd U. S. Pat. Office

TRADE **L-XX** MARK

# HIGH SPEED STEEL

AND OTHER

## TOOL STEEL OF QUALITY

The ATLAS STANDARD is HIGH. Every Grade we make MUST fulfill that STANDARD.

*Send for Catalog C.*

## ATLAS CRUCIBLE STEEL CO.

Works and General Offices:
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BOSTON
CLEVELAND
MINNEAPOLIS

Executive Offices, Buffalo

# TOOL STEELS

Blue Chip

High Speed

*and other*

*FIRTH-STERLING TOOL STEELS*

THE knowledge, experience and skill of SHEFFIELD combined with the best PITTSBURGH practice have made these steels the standards of QUALITY and UNIFORMITY wherever Tools are used

FIRTH-STERLING STEEL COMPANY

*McKeesport, Pa.*

NEW YORK BOSTON PHILADELPHIA
CLEVELAND PITTSBURGH
CHICAGO

*BARS* *TOOL BITS*

# Save That Scrap

## Let Us Convert It Into

HIGH ON SPEED
Trade Mark

## Steel

**Save Money and Obtain the Best.**

We succeed because our entire efforts are concentrated on one product. Ours is the only plant in the world devoted exclusively to the manufacture of High Speed Steel. That accounts for uniform superior *quality* and, best of all—*repeat orders.*

***It must succeed***
***It does succeed***

## Our Guarantee

We guarantee steel converted from your High Speed Steel scrap to be equal in quality to any High Speed Steel you have ever used; if not, you may return it and and we will pay you the market price for the weight of scrap accepted by us.

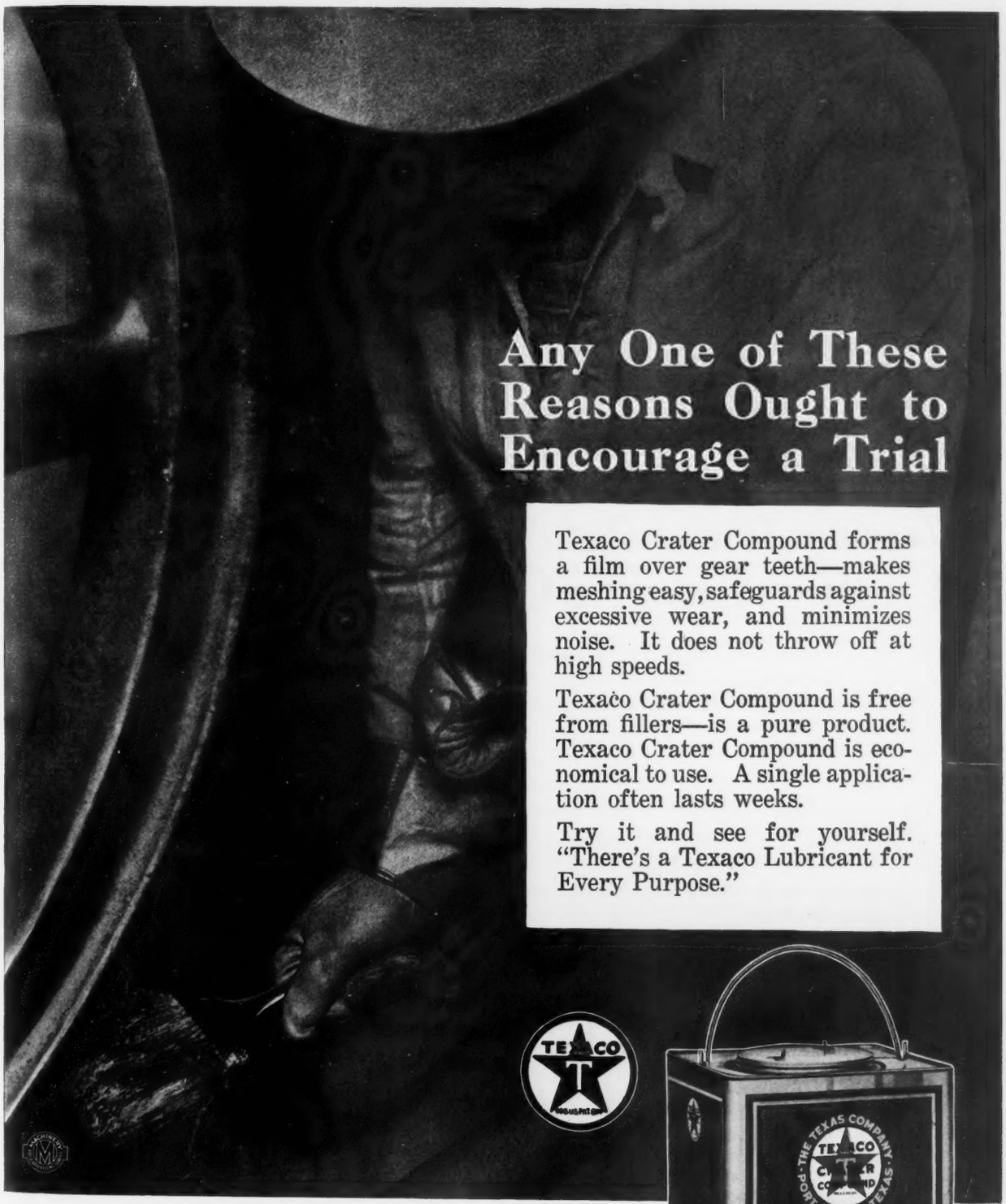
*Send for our Graphic Color Chart and Directions for treating High Speed Steel—Invaluable information for your men. Printed in form of hanger or pocket guide.*

ONONDAGA STEEL COMPANY, INC.
SYRACUSE, N.Y. U.S.A.

TEXACO CRATER COMPOUND

# TEXACO

The GREAT GEAR LUBRICANT



## Any One of These Reasons Ought to Encourage a Trial

Texaco Crater Compound forms a film over gear teeth—makes meshing easy, safeguards against excessive wear, and minimizes noise. It does not throw off at high speeds.

Texaco Crater Compound is free from fillers—is a pure product. Texaco Crater Compound is economical to use. A single application often lasts weeks.

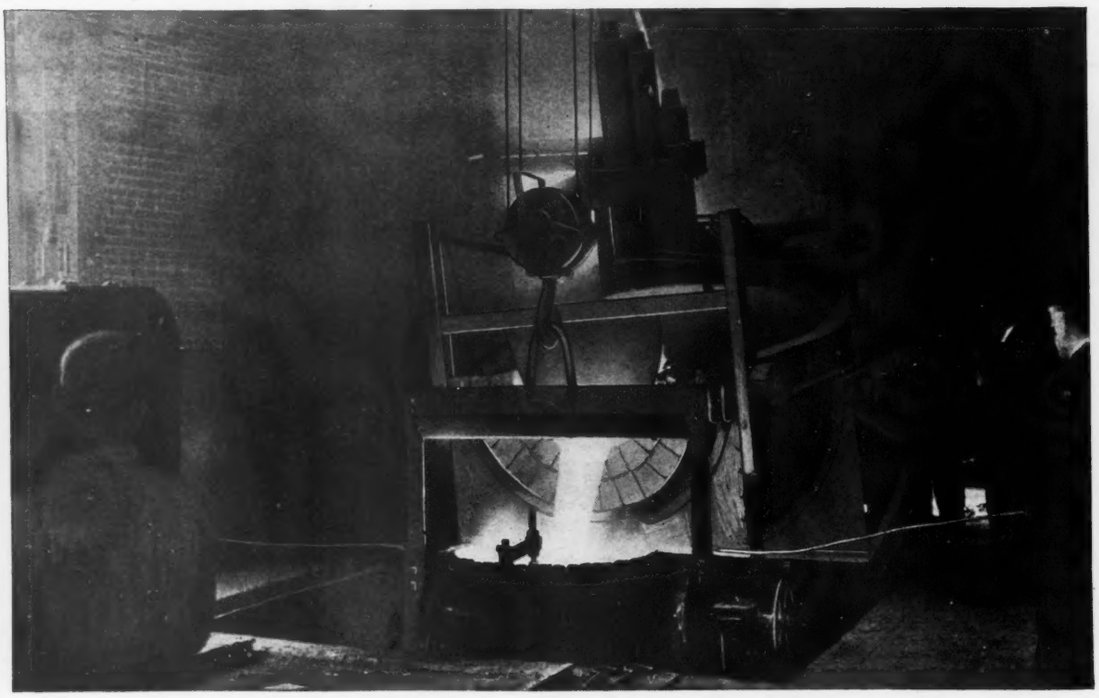
Try it and see for yourself. "There's a Texaco Lubricant for Every Purpose."

## THE TEXAS COMPANY

DEPARTMENT F., 17 BATTERY PLACE, NEW YORK

Houston Chicago New York

*Offices in Principal Cities*



*Teeming One of Our Electric Crucible Furnaces*

# Ludlum Electric Crucible Steel

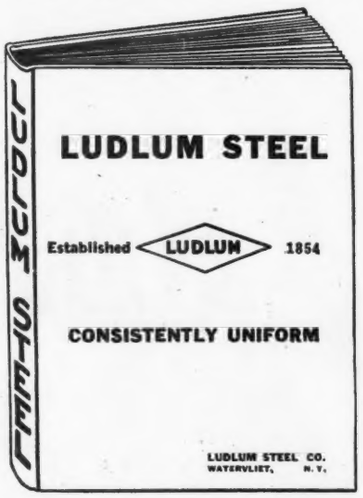
Every visitor to our plant tarries awhile here—for it is very fascinating to watch a Ludlum Electric Crucible Furnace teeming into the ladle.

The Ludlum Electric Crucible Furnace was developed entirely by us, to meet our own individual requirements. It produces unexcelled quality of absolutely controlled analysis.

**Do you realize that the majority of twist drill and milling cutter manufacturers in America are using Ludlum Steels?**

Ludlum "Consistently Uniform" Brands,

**MOHAWK EXTRA** — High Speed Steel
**POMPTON** — Carbon Tool Steel
**ALBANY** — Alloy Tool Steel
**ONEIDA** — Oil Hardening Tool Steel
**HURON** — Alloy Die Steel
**TETON** — Ball Bearing Steel
**YUMA** — Chrome Magnet Steel
**SEMINOLE** — "Fool Proof" Chisel Steel




This LUDLUM—Text Book is a complete treatise on the various tool steels. It describes the correct method of forging, hardening, tempering, annealing. It contains accurate calculation tables and other valuable information. Just ask us for it and it's yours, **free.**

## LUDLUM STEEL COMPANY

General Offices and Works
WATERVLIET, N. Y.

*Branch Offices*
New York City Philadelphia Cambridge
Cleveland Cincinnati Detroit Chicago
Buffalo

*Prompt shipments from warehouse stock at Watervliet, N. Y., Detroit, Mich., Chicago, Ill., and Cambridge, Mass. handled through our District Offices*

# *Physical Properties of*

# "SHELBY"

## *Cold-Drawn Seamless Steel Tubing for Mechanical Purposes*

**THE physical properties of "SHELBY" Cold-Drawn Seamless Steel tubing are embodied in the following tabulation which shows the grade of steel, temper, minimum physical properties, and a short description of the appearance of the tube, together with its application. These properties give a wide field of usefulness to "SHELBY" Tubing as do the numerous wall-thicknesses (20 gauge to 1¼-in.), diameters (¼ to 20-in.), and special shapes in addition to round (hexagon, oval, D-shaped, etc.)—factors which make "SHELBY" Seamless Steel Tubing equally adaptable for the manufacture of a small bushing or an elevator plunger.**

| Grade of Steel | TREATMENT | MINIMA | | | | | APPEARANCE, CONDITION AND APPLICATION |
|---|---|---|---|---|---|---|---|
| | | Yield Point Lbs. per Sq. In. | Tensile Strength Lbs. per Sq. In. | Elongation | | Reduction of Area | |
| | | | | % 2" | % 8" | % | |
| .17 Carbon | Temper "T" Finish Anneal | 45000 | 58000 | 17 | 10 | 30 | Surface dull and fairly scale free. Unless otherwise specified, material is always furnished to this temper. |
| .17 Carbon | Temper "U" Special Anneal | 38000 | 52000 | 32 | 15 | 35 | Surface dull and very slightly scaled. Material of this temper will stand a moderate amount of cold forming. |
| .17 Carbon | Temper "V" Medium Anneal | 35000 | 50000 | 45 | 22 | 45 | Surface dull and slightly scaled. Material of this temper being very soft and ductile, will stand considerable cold forming and is in excellent shape for machining. However, the tool should have a 30 deg. top rake, as the chips are long and tough. |
| .17 Carbon | Unannealed | 55000 | 63000 | 10 | 3 | 18 | Surface bright and scale free. Material of maximum strength with but slight ductility. |
| Boiler Tube | Temper "W" | 27000 | 47000 | 50 | 27 | 50 | Surface slightly scaled. This temper is suitable for all purposes; it stands cold forming and manipulation. |
| Boiler Tube | Temper "X" | 28000 | 50000 | 52 | 28 | 52 | Surface considerably scaled. Especially suitable for stay-bolts. |
| .35 Carbon | Temper "T" Finish Anneal | 65000 | 80000 | 18 | 10 | 20 | Surface dull and fairly scale free. Unless otherwise specified material is always furnished to this temper. It is used for mechanical purposes on parts requiring medium high tensile properties but little ductility. |
| .35 Carbon | Temper "U" Medium Anneal | 48000 | 65000 | 32 | 18 | 32 | Surface dull and slightly scaled. This temper is suitable for purposes requiring medium tensile strength and ductility and shock resisting power. This temper will stand reasonable cold forming. |
| .35 Carbon | Unannealed | 70000 | 85000 | 10 | .. | 12 | Surface bright and scale free. This material has maximum strength but hardly any ductility, and should not be used where subjected to shock. Material, provided it is not subjected to cold working or manipulation, and is to be heated above 500°C during subsequent manufacture, should be furnished to this temper. |

*The Recognized Standard of Seamless Steel Tubing*

*Ask for "NATIONAL" Bulletin No. 17—The Manufacture and Use of "SHELBY" Seamless Steel Tubing.*

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| Catalogue Number | Outside Diameter | Inside Diameter | Length |
|---|---|---|---|
| B 90 | ¾ | ⅝ | 1 |
| B 91 | ..... | ..... | 1¼ |
| C 95 | ..... | ..... | 2¼ |
| C125 | ⅞ | ⅝ | 1½ |
| C167 | ⅞ | ⅝ | 1 |
| D168 | ..... | ..... | 1¼ |
| D169 | ..... | ..... | 1½ |
| E172 | ..... | ..... | 2¼ |
| D010 | ⅞ | ¾ | 2¼ |
| C222 | ⅞ | ¾ | 1 |
| D224 | ..... | ..... | 1½ |
| D242 | 1 | 15/16 | 1¼ |
| C250 | 1 | ¾ | ¾ |
| D251 | ..... | ..... | 1 |
| D252 | ..... | ..... | 1¼ |
| D253 | ..... | ..... | 1½ |
| D254 | ..... | ..... | 1¾ |
| E256 | ..... | ..... | 2¼ |
| E257 | ..... | ..... | 2½ |
| E259 | ..... | ..... | 3 |
| D264 | 1 | ⅞ | 1¾ |
| D311 | 1 1/16 | ⅞ | 1½ |
| E315 | ..... | ..... | 2½ |
| F327 | 1⅛ | ¾ | 2½ |
| C345 | 1⅛ | ⅞ | ¾ |
| D346 | ..... | ..... | 1 |
| D347 | ..... | ..... | 1¼ |
| D348 | ..... | ..... | 1½ |
| E349 | ..... | ..... | 1¾ |
| E350 | ..... | ..... | 2 |
| E352 | ..... | ..... | 2½ |
| E355 | ..... | ..... | 3¼ |
| D362 | 1⅛ | ⅞ | 1½ |
| F011 | 1 1/16 | ¾ | 2½ |
| E392 | 1 1/16 | ⅞ | 2 |
| D403 | 1 1/16 | ⅞ | 1¼ |
| E408 | ..... | ..... | 2½ |
| D419 | 1 1/16 | 1 | 1¾ |
| E422 | ..... | ..... | 2½ |
| E434 | 1¼ | ⅞ | 1¾ |
| D461 | 1¼ | 1 | 1 |
| D462 | ..... | ..... | 1¼ |
| E463 | ..... | ..... | 1½ |
| E464 | ..... | ..... | 1¾ |
| E465 | ..... | ..... | 2 |
| E466 | ..... | ..... | 2¼ |
| E467 | ..... | ..... | 2½ |
| F469 | ..... | ..... | 3 |
| F471 | ..... | ..... | 3½ |
| F527 | 1 1/16 | 1 | 2½ |
| E538 | 1 1/16 | 1 1/16 | 1½ |
| E542 | ..... | ..... | 2½ |
| F546 | ..... | ..... | 3½ |
| F570 | 1⅜ | ⅞ | 2 |
| E597 | 1⅜ | 1 | 1¼ |
| E599 | ..... | ..... | 1¾ |
| F602 | ..... | ..... | 2½ |
| F604 | ..... | ..... | 3 |
| E628 | 1⅜ | 1⅛ | 1½ |
| E629 | ..... | ..... | 1¾ |
| E630 | ..... | ..... | 2 |
| E631 | ..... | ..... | 2¼ |
| E632 | ..... | ..... | 2½ |
| F634 | ..... | ..... | 3 |
| E712 | 1 1/16 | 1⅛ | 1½ |
| D729 | 1 1/16 | 1 1/16 | 1¼ |
| E732 | ..... | ..... | 2 |
| F735 | ..... | ..... | 2¾ |
| E754 | 1 1/16 | 1¼ | 3 |
| G770 | 1½ | 1 | 2½ |
| E802 | 1½ | 1⅛ | 1½ |
| F804 | ..... | ..... | 2 |
| E838 | 1½ | 1¼ | 1½ |
| E840 | ..... | ..... | 2 |
| E841 | ..... | ..... | 2¼ |
| F842 | ..... | ..... | 2½ |
| F844 | ..... | ..... | 3 |
| E910 | 1 1/16 | 1 1/16 | 1½ |
| G916 | ..... | ..... | 3 |
| F982 | 1⅝ | 1⅛ | 1¾ |
| G1002 | 1⅝ | 1 1/16 | 2½ |
| F1016 | 1⅝ | 1¼ | 1¾ |
| F1019 | ..... | ..... | 2½ |
| G1021 | ..... | ..... | 3 |
| H1025 | ..... | ..... | 4 |
| H1028 | ..... | ..... | 4¾ |
| F1036 | 1⅝ | 1 1/16 | 2½ |
| E1051 | 1⅝ | 1⅜ | 2 |
| G1085 | 1 11/16 | 1 1/16 | 2 |
| F1102 | 1 11/16 | 1¼ | 2 |
| H 012 | 1 11/16 | 1 1/16 | 5¼ |
| F1155 | 1 11/16 | 1 1/16 | 2½ |
| F1190 | 1¾ | 1¼ | 1¾ |
| H1194 | ..... | ..... | 2¾ |
| F1234 | 1¾ | 1⅜ | 2¼ |
| G1237 | ..... | ..... | 3 |
| F1255 | 1¾ | 1 1/16 | 2¼ |
| G1262 | ..... | ..... | 4 |
| E1274 | 1¾ | 1½ | 1¾ |
| F1276 | ..... | ..... | 2¼ |
| F1277 | ..... | ..... | 2½ |
| F1281 | ..... | ..... | 3½ |
| G1283 | ..... | ..... | 4 |
| G1445 | 1⅞ | 1½ | 2½ |
| H1449 | ..... | ..... | 3½ |
| H1451 | ..... | ..... | 4 |
| F1486 | 1⅞ | 1⅝ | 2¼ |
| G1506 | 1 13/16 | 1 1/16 | 2 |
| H1613 | 2 | 1½ | 2½ |
| H1617 | ..... | ..... | 3½ |
| F1652 | 2 | 1⅝ | 1¾ |
| G1657 | ..... | ..... | 3 |
| F1699 | 2 | 1¾ | 3 |
| H1793 | 2 1/16 | 1 13/16 | 4 |
| H1904 | 2⅛ | 1⅝ | 3 |
| G1949 | 2⅛ | 1¾ | 2¾ |
| G2000 | 2⅛ | 1⅞ | 4 |
| G2084 | 2 3/16 | 1 11/16 | 2 |
| H2086 | ..... | ..... | 2½ |
| F2176 | 2 3/16 | 1 13/16 | 2 |
| G2248 | 2¼ | 1¾ | 1¾ |
| H2255 | ..... | ..... | 3½ |
| H2261 | ..... | ..... | 5 |
| F2349 | 2¼ | 2 | 2 |
| G2353 | ..... | ..... | 3 |
| H2630 | 2⅜ | 1¾ | 3½ |
| I2636 | ..... | ..... | 5 |
| H2929 | 2 7/16 | 1 13/16 | 3 |
| G3031 | 2 7/16 | 2 1/16 | 3½ |
| H3168 | 2½ | 2 | 2½ |
| H3172 | ..... | ..... | 3½ |
| H3176 | ..... | ..... | 4½ |
| H3228 | 2½ | 2⅛ | 3 |
| H4013 | 2 13/16 | 2 1/16 | 3½ |

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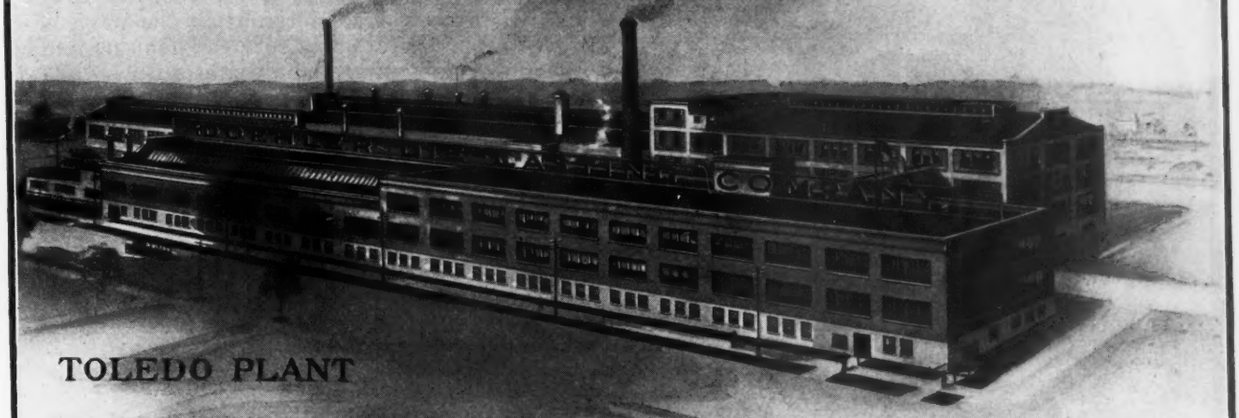

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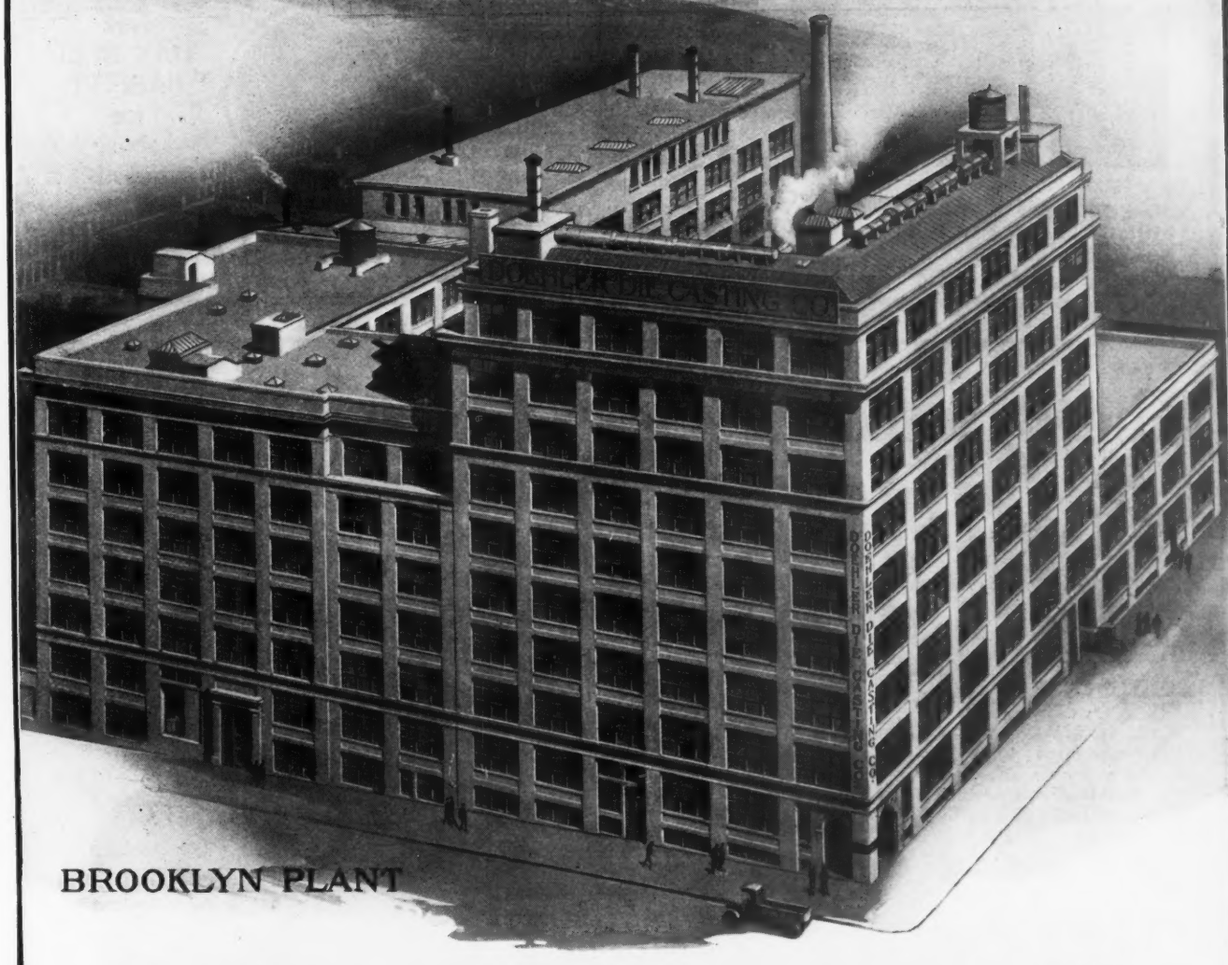

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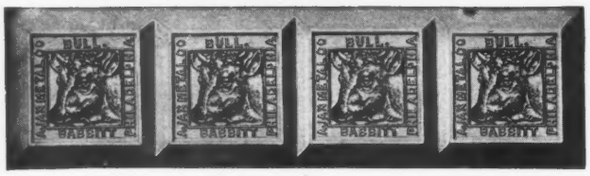

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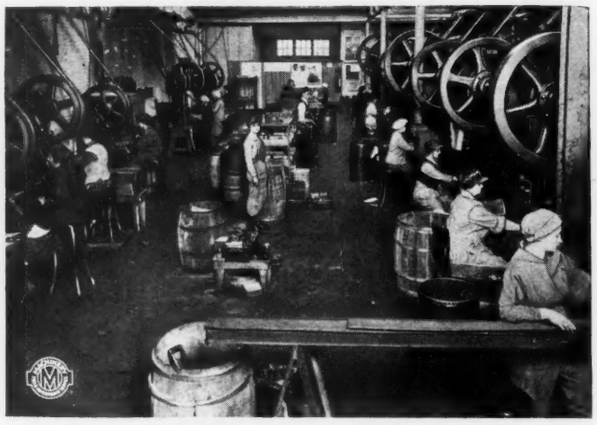

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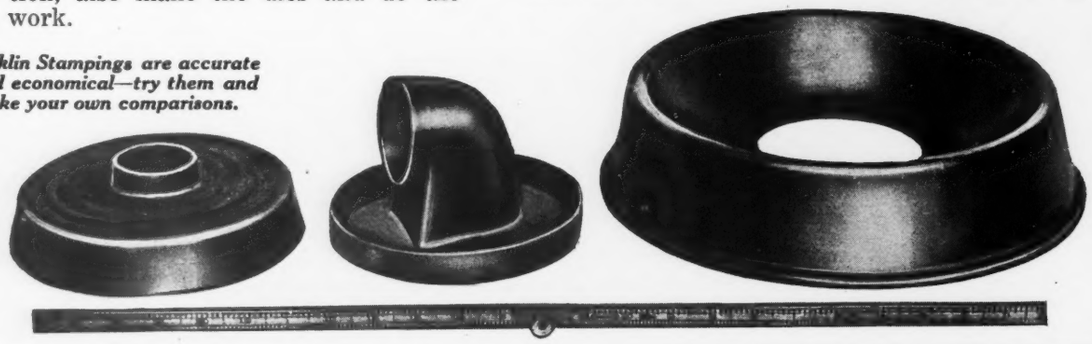

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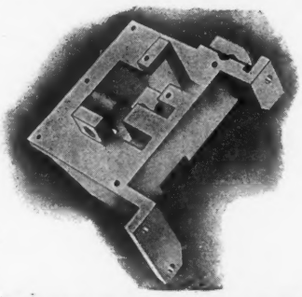

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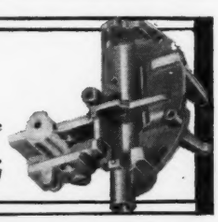

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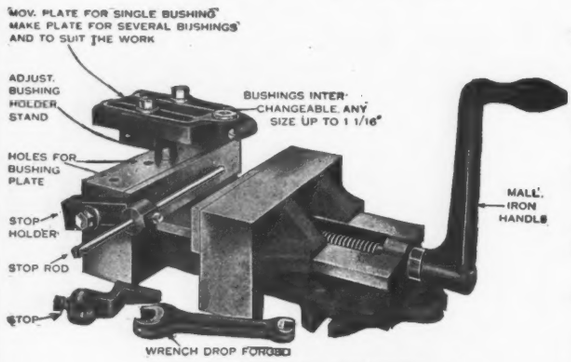


Fig. 1. With Jig Attachments.

Always a good vise for general shop use on driller, miller, shaper, or planer, and at the same time holds work for duplicate drilling without the cost of a jig.

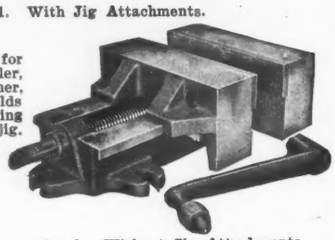

Fig. 2. Without Jig Attachments.

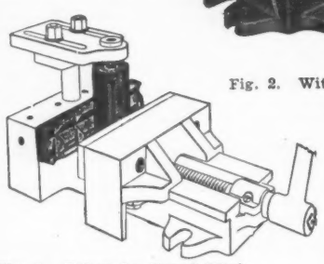

Fig. 3. V-Jaw for Round Work.

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No. 4, jaws 9", opens 7"; with attachments, $27.50; without, $25.00. List.

No. 5, jaws, 12", opens 9½", with attachments, $40.00; without, $36.00. List.

## DRILL SPEEDER

No. 2, with chuck, drills 0" to 5/16". List, $25.00.

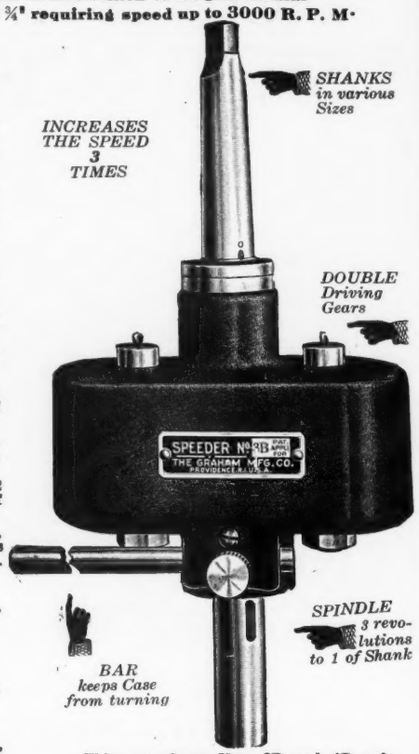
No. 3, with chuck, drills 0" to ½". List, $27.50.

No. 3B, with No. 1 Morse hole instead of chuck, $27.50.

No. 4, with chuck, drills 0" to ¾". List, $40.00.

No. 4B, with No. 2 Morse hole instead of chuck, $33.00.

No. 2L, with chuck, drills 0" to ⅝". Has feed lever mechanism. List, $33.00.




This cut shows Nos. 3B and 4B only. There are two other styles and sizes.

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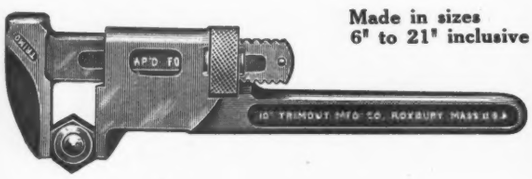


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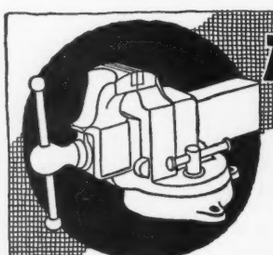
**Observe the cut of the Trimo Nut Wrench at the top which has all of the necessary good qualities for a machine wrench and which is especially well adapted to railroad use.**

## Trimont Manufacturing Company

**Roxbury (Boston) Mass.**



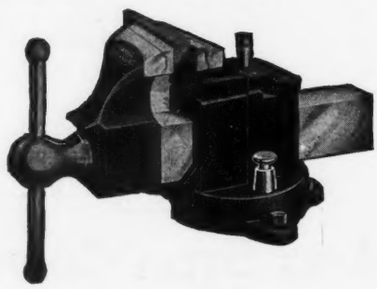
# MASSEY VISES for STRENGTH and SERVICE

In the big shops—Massey Vises are used in great numbers and have gained a most enviable reputation. Not without cause, however, for in Massey is found the ultimate of strength, ease of handling and service. Nothing we could tell you about the superior qualities of Massey Vises would be half so convincing as an actual test in your own shop under ordinary working conditions. Better vises cannot be bought at any price. Made in various styles and sizes to fit any need. Get our new catalog No. 18.

**MASSEY VISE CO.** 547 W. Washington Blvd. CHICAGO

# Machinists' Swivel Vise

with self-adjusting jaw that is as strong and durable as any solid jaw, and a Swivel Bottom that gives any desired adjustment to right or left, and is solid and firm at any angle. We make all sorts of good vises, and have been leaders in this line for forty years.

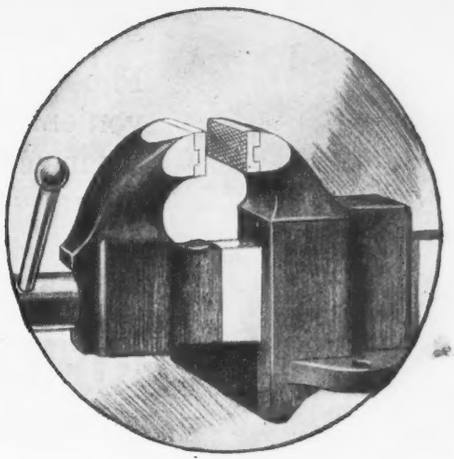


Send for catalogue and price list.

**PRENTISS VISE COMPANY,** 106-110 Lafayette St. NEW YORK

Sole Agents for Canada: A. Macfarlane & Co., Coristine Bldg., Montreal

# COLUMBIAN
## Sledge-Tested VISES



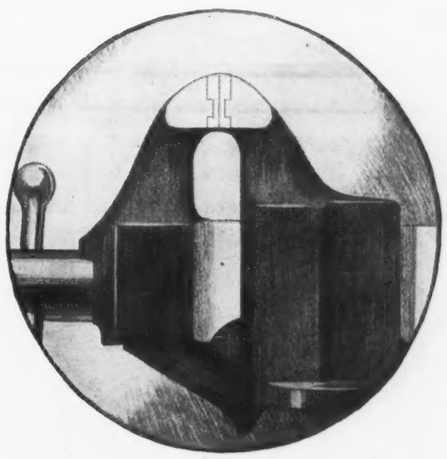
## Any Vise a Machine Shop Needs

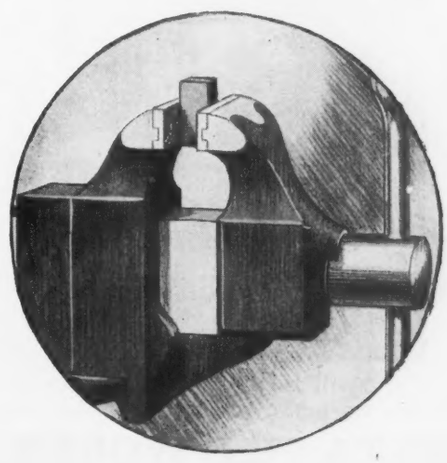
EVERY type of vise that is ever required in a modern machine shop is included in Columbian Sledge-Tested Vises. This makes it possible to standardize Columbian Vises and to obtain the advantages of malleable iron vises with removable (renewable) steel jaws.

Columbian Sledge-Tested Vises are twice as strong as cast iron. Vise breakage is practically unknown in shops equipped with Columbian Vises.

Besides the obvious advantages just mentioned, Columbian Vises embody a dozen detailed refinements which the expert workman soon discovers. Swivel bases and adjustable jaws set and release easily, handles always slide freely, filings cannot work into the screw.

Columbian Sledge-Tested Vises embody all the good features of other vises and distinctive features of their own. They sell for the same price as cast iron vises.





**The Columbian Hardware Co.**
**Cleveland**

Increased range to your engine lathe means added profits if properly used.

# PHOENIX TURRET ATTACHMENTS

are not experiments; they meet a definite need and have become an important part of the engine lathe for many classes of work.

Phoenix Turret Attachments are rigid, convenient and durably accurate devices that mean economical production on short run work of many operations.

***Ask us about them***

## PHOENIX MANUFACTURING CO.

**EAU CLAIRE** **WISCONSIN**

**Cleveland Office: 913-15 Engineers Bldg.**

# THE WINNERS

**Used in Every Shop Where Economy and Efficiency Are Practiced**

The File you will eventually use—as perfect as will and skill can make—clean, strong, sharp teeth

## DELTA FILE WORKS

PHILADELPHIA, U. S. A.

***Used in Every Shop Where Economy and Efficiency Are Practiced***

# GROBET

## SWISS FILES

bearing the rabbit trade mark are being constantly shipped to us from Switzerland, and the quality to-day is, if anything, better than before the war.

***"Progress" and "Improvement" are the watchwords of the GROBET factory.***

## MONTGOMERY & CO.

INCORPORATED

**Sole Agents for United States and Canada**

**105 FULTON ST. NEW YORK CITY**

*Help Speed Production with Convenient Shop Accessories*

# THE CHAMPION LINE

## Vises—Tool Holders—Shop Furniture

Back up skilled workmen and good machines. Their convenience and quality make them valuable assets to production. The heavy support at the cutting edge of the CHAMPION TOOL HOLDER safeguards the tools from chatter or mash, while the close-up grip of the set screw permits the efficient use of short length bits.

The CHAMPION VISE has swiveling and elevating features that enable the user to adjust the work to any convenient angle and hold it there rigidly. Full line of vises.

The Champion Line of All Steel Shop Furniture includes portable vise stands, work benches, bench trays, tables, etc.

*Send for our catalogue*

# THE WESTERN TOOL & MFG. COMPANY

**SPRINGFIELD** **OHIO, U. S. A.**

FOREIGN AGENTS: Alfred Herbert, Ltd., Great Britain, Italy, France, etc. V. Lowener, Copenhagen, Stockholm. Spliethoff, Beeuwkes & Co., Rotterdam. W. R. Grace & Co., Chili, Peru and Bolivia. LOCAL AGENTS: Any first-class Hardware House.

Fits any vise—grips all shapes, **exerting equal pressure at all contact points**—holds even slender rods and screws—needs no adjustment. The cheapest **important** equipment you ever bought.

*Order one or a dozen sets. If they don't save their cost in 30 days send them back.*

# The UNIVERSAL VISE ATTACHMENT

The Device That Completes the Vise

**THE UNIVERSAL EQUALIZER CO.**

**CINCINNATI OHIO, U. S. A.**

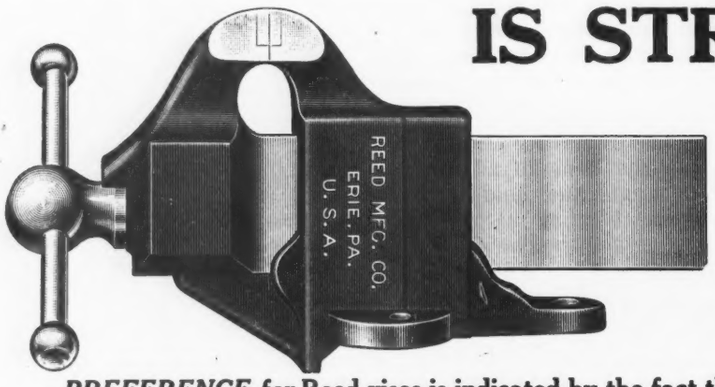
**NEW YORK OFFICE: 149 BROADWAY**

OVER-SEAS REPRESENTATIVE

ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA

51 CHAMBERS ST. NEW YORK, U.S.A.

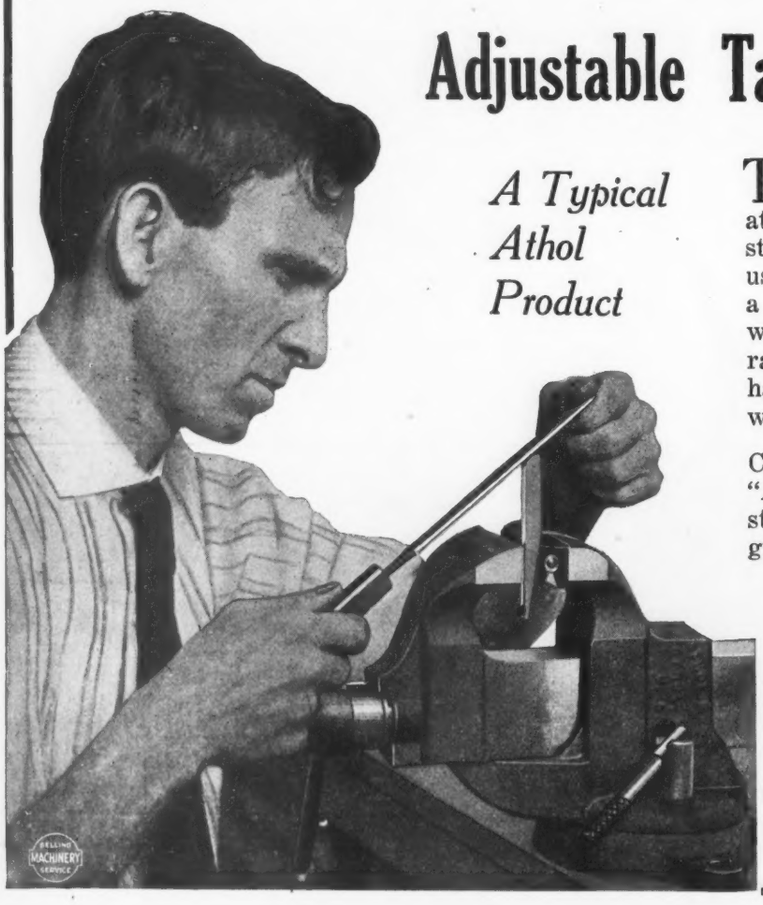
# PREFERENCE FOR REED VISES IS STRONGEST




## WHERE THEY'VE BEEN KNOWN THE LONGEST

***PREFERENCE*** **for Reed vises is indicated by the fact that they are standard equipment in scores of shops where mediocre tools are not tolerated, and where quality tools are deemed first requisite to quality work. For more than twenty years we have made our vises up to the highest standard. They are stronger and last longer. Every part machined to close limit gauges. All parts perfectly interchangeable. Send for Catalog.**

## REED MANUFACTURING CO., ERIE, PA.



# Adjustable Taper Attachment

*A Typical Athol Product*

THIS is no makeshift device; but a carefully designed, well-made attachment which meets with instant approval among all vise users. Its strong, positive grip is a wonderful help to the man who works all day at a vise. Its wide range of adjustment permits handling a variety of odd shaped work to advantage.

Construction is fully up to the "Athol" standard—strength where strength is needed—and its grip is guaranteed.

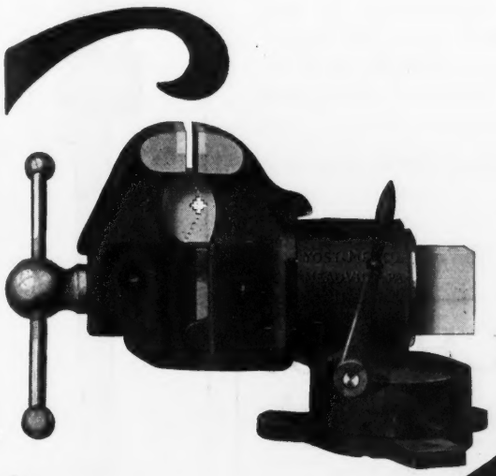
*Details of this attachment and of the whole "Athol" line, including the famous "Athol-Starrett" Vise, in Catalog No. 34. Send for a Copy.*

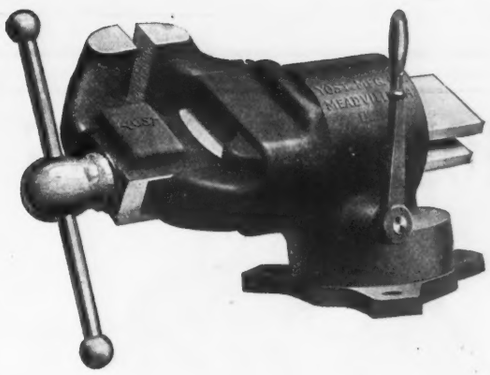
## ATHOL MACHINE CO.

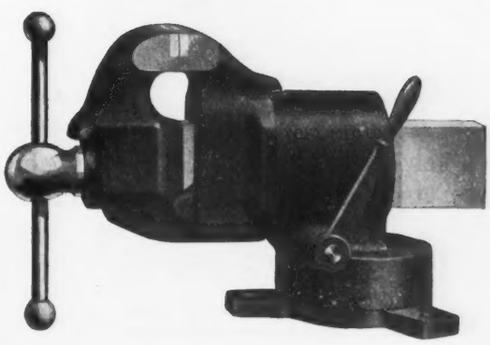
ATHOL MASS., U. S. A.

*First Choice of the Critical*

# Yost







Yost Vises have become the first choice of the most critical of judges—the skilled mechanic. These tools are well designed, properly balanced and absolutely dependable under all conditions.

The cuts illustrate:—

The Yost Patented Universal Double Swivel Vise, which revolves upon two distinct complete circles. It is quickly and positively adjustable to any degree in either by the action of a single lever. Work may be completed at one setting.

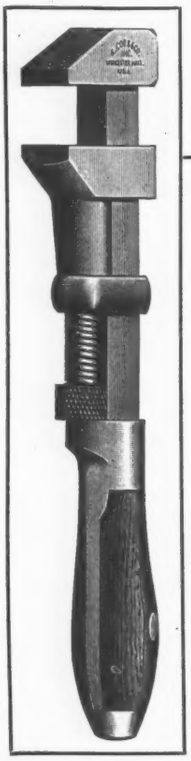
The Yost Patented Universal Double Swivel Combination Pipe Vise (above)—similar in construction to the vise described, with the added feature of drop forged pipe jaws of crucible steel. These jaws are easily replaced.

***Send for catalogue which describes complete line.***

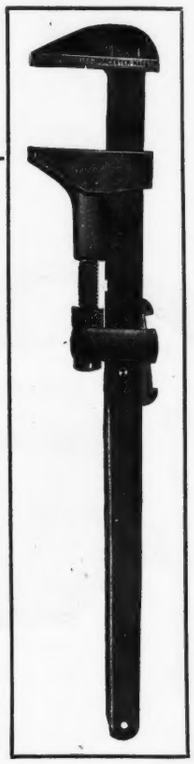
**YOST MANUFACTURING CO.**

**MEADVILLE PA., U. S. A.**

# "COES" WRENCHES



*One of the most important tools in the workman's kit is his wrench.*



A "Coes" Wrench is sure to be one of the most popular. Always dependable, stronger by actual tests than other wrenches, easily manipulated and convenient in use, Coes Wrenches are made in styles and sizes that range from the small 6" model to the 72" steel handle railroad wrench—and each size is capable of the most strenuous work within its range.

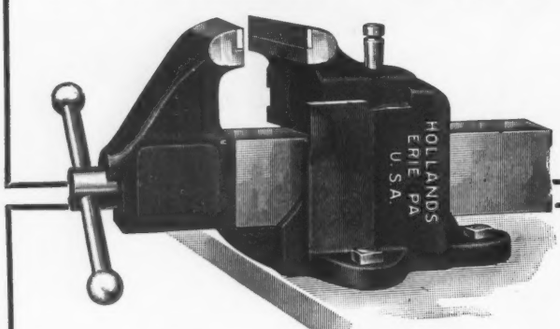
Choose the style and size that suits your needs then ask your dealer to show it.

*Catalogue of Coes Tools Mailed on Request*

**COES WRENCH CO.**
**WORCESTER MASS., U.S.A.**

AGENTS: J. C. McCarty & Co., 29 Murray St., New York. 438 Market St., San Francisco, Cal. 1515 Lorimer St., Denver, Colo. AGENTS: John H. Graham & Co., 113 Chambers St., New York. London, E. C., 118-122 Holborn. Fenwick Freres, Paris, France.

# HOLLANDS VISES



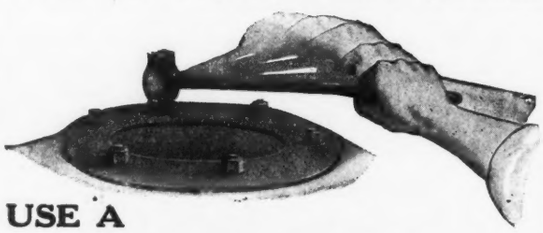

Stationary base type with swivel jaw

Thirty-two years spent in making vises has developed the Hollands Line. These vises embody the most valuable modern improvements. They are rigid, durable and economical.

*"Every Kind for Every Purpose." Send for our Catalogue.*

Established 1887
**HOLLANDS MFG. CO.**
**ERIE, PA., U. S. A.**

## Don't Waste Time Turning Nuts With An Old-Fashioned Wrench



USE A
**Favorite** Reversible Ratchet **Wrench**

which is a time-saver because its movement is quick and positive, cutting out all the lost motion of the old-fashioned open end wrench.

Cannot slip off the nut and bark the knuckles.

**GREENE, TWEED & CO.**
*Sole Manufacturers*
**109 Duane St., New York**

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## TRUCKS for ECONOMY

*How do you move your loads?* Several husky men with heavy wooden trucks? Or a boy, a Holyoke Truck and some platforms? Both methods work; but there's a difference in cost that will amaze you.

Holyoke Trucks are raised and lowered, steered, locked and released by pressure of the handle. Simple, convenient and *safe*. The lessened danger of injury to work or men and the low cost of handling heavy loads makes Holyoke Trucking pay big returns.

Holyoke Trucks are made in several styles, in sizes to carry up to 4000 lbs. Whether your plant needs one or fifty—write us. We'll show you *how* to cut handling costs.

**HOLYOKE TRUCK CO.**

**112 RACE ST., HOLYOKE, MASS., U. S. A.**

**Export Office, 77 BROAD STREET, NEW YORK CITY.**

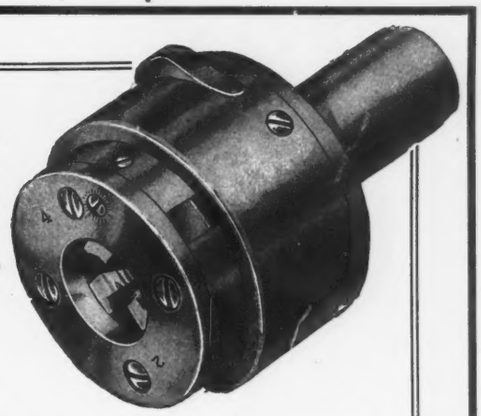
H & G

## Automatic Self-Opening Die Head

***Try It for Your Most Troublesome Threads***

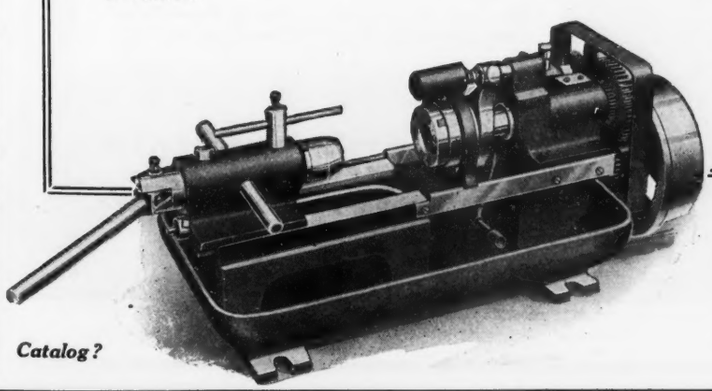
A compact, reliable, foolproof die head that eliminates all threading troubles. The H & G Automatic Self-Opening Die Head not only fulfills its mission, but doubles output as well.

Simple, easily adjusted and positive in action, it cuts threads uniformly true—to a given point right up to the shoulder—in the least possible time. The die head runs on, opens and comes back quickly—chasers are held firmly and cannot taper threads.



Operating cams are fully protected from chips. All parts are hardened, ground and interchangeable.

The H & G Threading Machine is another development which has far exceeded expectations. Let us tell you about it.

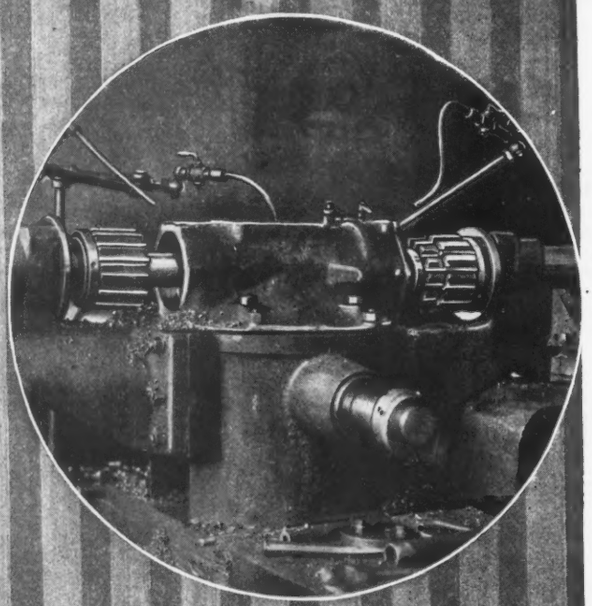


*Catalog?*

**EASTERN MACHINE SCREW CORP.**

**NEW HAVEN CONN., U. S. A.**

McCrosky
COST CUTTING TOOLS



## A Job That Tests The Reamer

The shop foreman in the Truck Department of the Packard Plant says McCrosky Reamers are the best he has ever used. They run 20 hours a day for the production of 22 carriers and require grinding only about every ten or twelve days.

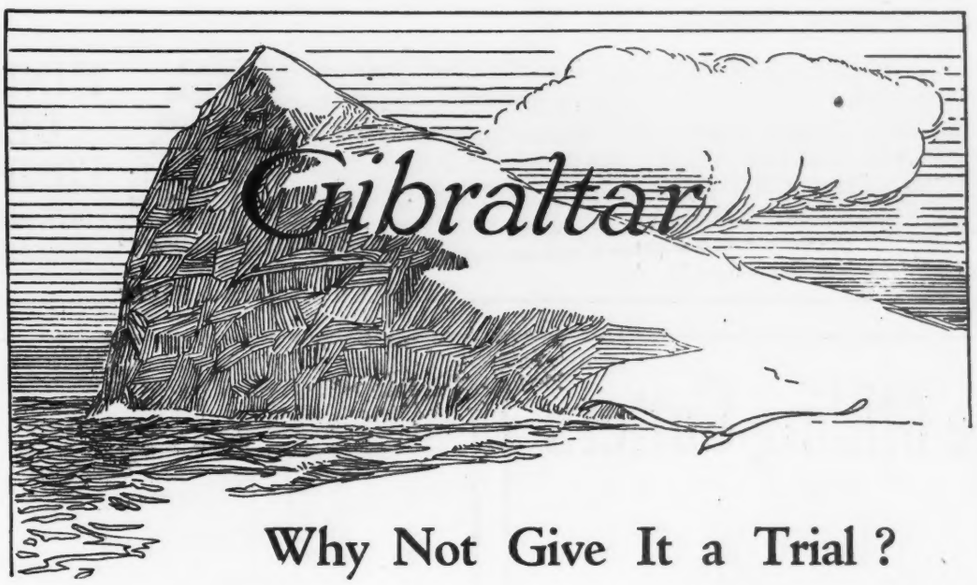
These truck differential carriers require the reaming of five diameters — 5.1875″, 5.1181″, 5.1181″ and 5.9375″ to 1 7/16″, 1 3/16″, 1 5/16″ and 2¼″ depths respectively in the top half, and 7.480″ to 1½″ depth in the bottom half. Allowable error is + 0.0010″; actual error is 0.0005″.

The quality of steel—the workmanship, simplicity and strength of McCrosky Reamers guarantee maximum results.

*Let us tell you more about them.*

**McCrosky Tool Corporation**
FORMERLY McCROSKY REAMER CO.
MEADVILLE, PENNA., U. S. A.
New York, 30 Church St. Detroit, Kresge Bldg.
Export Manager, B. Whittaker, 21 State Street, New York

McCrosky Tool Corporation




## Why Not Give It a Trial?

NOVO SUPERIOR — The steel without an equal.

NOVO — The standard in high-speed steel.

INTRA—The non-shrinking tungsten alloy tool steel.

GIBRALTAR—The tool steel without a risk.

*Write for our latest stock list.*

One of the largest manufacturers of chasers in the country uses Gibraltar Steel exclusively for his products. He has tried all the best grades of steel and finds Gibraltar the most satisfactory.

It hardens readily, without shrinking or warping, machines easily and holds its cutting edge for long periods between grinds.

Gibraltar is also used for shear blades, taps, punches, blanking dies, etc., by many manufacturers who formerly used more expensive steels.

It never fails to increase output and cut costs. Why not give it a trial?

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PACIFIC COAST REPRESENTATIVES, Berger & Carter Co., Pacific Tool & Supply Div., San Francisco, Cal.

ESTABLISHED 1837

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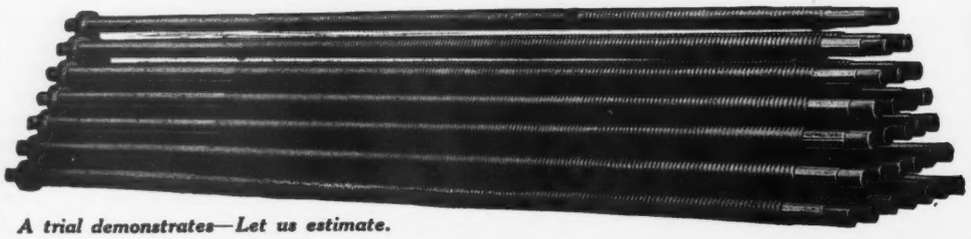
*Power, Feed, Lead*
*Worms, Screws, Spirals*

Hindley Screws are cut on specially designed machines which remove the metal with the least possible disturbance of its fiber. They are accurate, durable and better finished than screws cut by any other process.



**HINDLEY GEAR COMPANY**
1105 Frankford Avenue
PHILADELPHIA, PA.

*A trial demonstrates—Let us estimate.*

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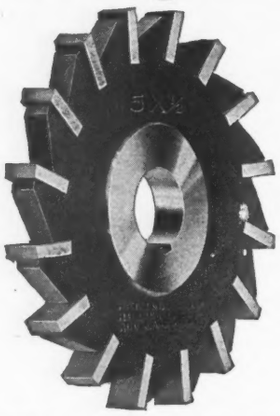


Made by the New
**ECONOMY PROCESS**
will save you about

59% in 8" x 1" size
52% " 6" x 1" "
43% " 6" x ½" "
35% in 4" x ¾" size
29% " 3½" x ½" "
Others in proportion

*Worth Investigating? Write for complete lists*

**H. H. ARNOLD COMPANY**
ROCKLAND MASS., U.S.A.

Are the result of over thirty years of experience in the manufacture of high grade cutting tools, both carbon and high speed.

We endeavor to give to the user of these tools the very best material and workmanship obtainable together with prompt service.

*Write for prices and delivery.*
*Estimates given on special tools.*

AMERICAN MACHINE PRODUCTS COMPANY
DETROIT MICHIGAN, U. S. A.

# ROGERS TOOLS

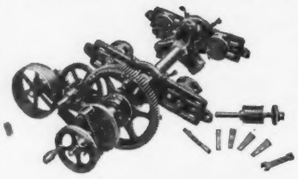
Reamers
Measuring Standards
Adjustable Hollow Mills

**The John M. Rogers Works, Inc.**
Gloucester City, N. J., U. S. A. 1865-1919

# YOU WANT THIS!

because it's going to save you money. It's the

## Underwood Portable Boring Bar



You can take it to the job and bore all cylinders in place.

Other labor-saving devices.

*Get complete Catalog*

**H. B. UNDERWOOD CORPORATION**
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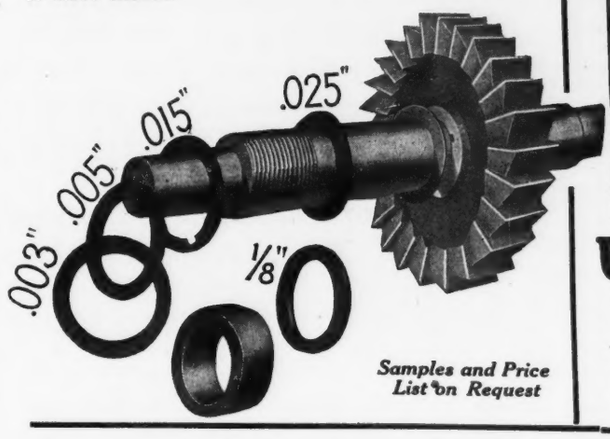
When you buy special tools and accessories from a specialist you get better tools at less cost than when you make them yourself—even such small items as

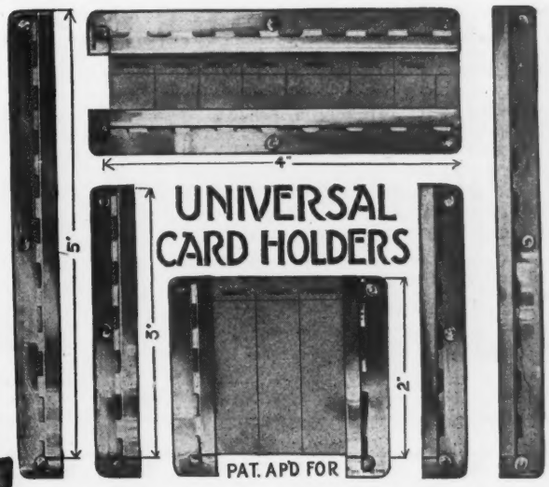
## SPACING WASHERS

**To Prove This, Try Ours on Your Next Order**

Stock sizes—with or without standard keyways—for arbors of the following diameters: ⅜, ½, ⅝, ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1⅝, 1¾, 1⅞, 2, 2¼, 2½, 3 and 3½ inches. Stock thicknesses: .003, .005, .015 and .025 inches. To order, .0015 to 3.000 inches.




*Samples and Price List on Request*




Card holders for stock bins, shelves, trucks, stock boxes, etc., are another small but important commodity more economically manufactured by people in that line of business.

## Universal Card Holders

are adaptable for cards of various proportions, can be used in either vertical or horizontal position and permit the use of almost the entire card which can be readily inserted and removed.

Four sizes in stock—2, 3, 4 and 5 inches. Other sizes to order.

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REGISTERED TRADE-MARK

Look for the C Carpenter Mark

It is the sign of 49 years' experience in the manufacture of accurate screw cutting tools. It promises dependable, high grade, uniform quality, always.

*Send for Catalogue.*

*The*
**J.M.CARPENTER TAP & DIE CO.**
PAWTUCKET RHODE ISLAND

## COWLES Milling Cutters

Quick Deliveries *Send Inquiries*

We make nothing but High Speed Steel Milling Cutters.

We make many other types

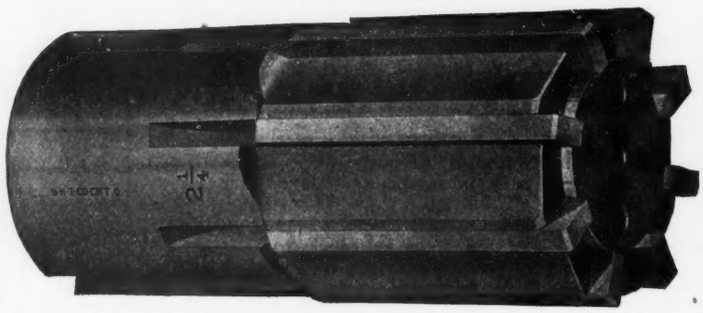
*Quality First*

**COWLES TOOL COMPANY**
CLEVELAND OHIO

# THE ACME RIGID H.S. EXPANDING BLADE SHELL REAMERS

You can spend two hours of a toolmaker's time underlying blades and grinding reamers down to size for every few hours' use if you want to. With the Acme reamers ninety per cent of the time thus wasted is saved. With the Acme reamers you can get an expansion as fine as .0005 in a few seconds and a maximum expansion of the blades of ⅛". When the blades are worn out they can be renewed.

Try an Acme against any reamer you have ever used and see the great difference in general efficiency and lower cost of maintenance. Write for an Acme bulletin today.

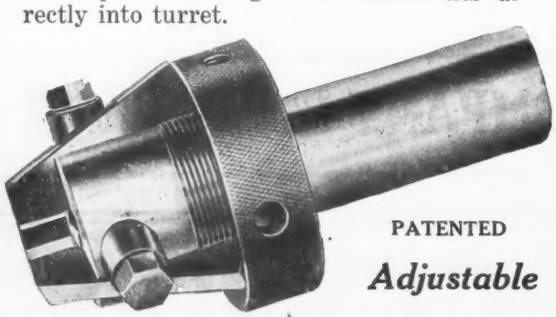


**The Schellenbach-Hunt Tool Co., Cincinnati, O.**

FOREIGN AGENTS: Burton, Griffiths & Co., Ltd., London, England. Markt & Co., 193 West St., New York; Germany and Italy. New York Export and Import Co., 133-137 Front St., New York; China, Japan and Australia. Williams & Wilson, Montreal, Canada. J. S. Cock, Christiania, Norway.

# Send Data Genesee Tools

That's what the coupon says. The data is well worth having—so send the coupon today. The Genesee Hollow Mill holds to size—never clogs—adjusts to within 0.001". One set of blades outlasts from three to five solid tools—can be replaced at small cost. Stock passes through tool—shank fits directly into turret.



PATENTED

*Adjustable*

**GENESEE MFG. CO., ROCHESTER, N. Y.**

*Manufacturers of the*

## GENESEE HOLLOW MILL

**And Other High Grade Metal Specialties**

GENESEE MANUFACTURING COMPANY,
Rochester, N. Y.
Send data Genesee Tools.
Name .....
Address .....
MACHINERY, 8-19.

# INDICATING CALIPERS

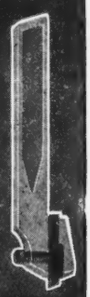
***For Machinists, Pattern, Tool and Model Makers***

All the features of Outside Calipers, Rule, Indicator, and Magnifier in one simple, accurate tool which is easily read and can be manipulated with one hand.
3" size graduated in 64th inches; scale enlarges 2 times.
2" size graduated in 100th inches; scale enlarges 3 times. Ask your dealer—or write us for details.

**Indicating Calipers Co.**
**506 E. 19th St., New York City**

# RED-E TOOLS

It will pay you to send for catalogue of our full line of time and labor saving Tools and Dogs



# Red-E Shaper Tool

with the cutter back of the line of force overcomes all chatter

**The Ready Tool Co.**
Makers of the tool "with the tool steel bearing"
**650 RAILROAD AVENUE**
**Bridgeport, Conn.**

# REED MICROMETERS

**Highest in Value—Lowest in Price**

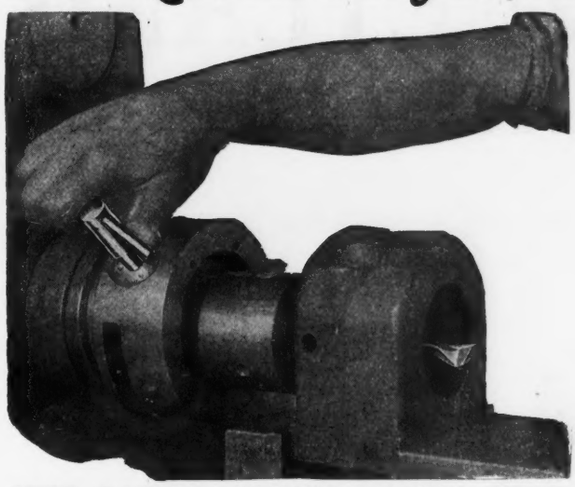
*Guaranteed for Accuracy and Long Service*

## REED SMALL TOOL WORKS

*Send for Price List No. 1*

George H. Alexander, Birmingham, England, General Representative in the British Isles
**Cherry and Vine Sts.** **WORCESTER, MASS., U.S.A**

# For Quick Adjustment of Boring Tools



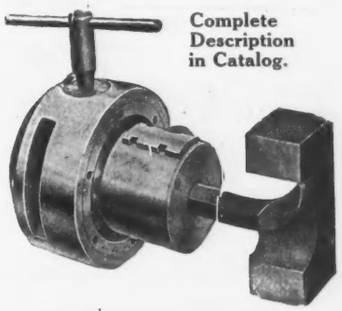
## on Miller, Boring Mill, Drill Press and Lathe

Modern requirements leave no time for the old, leisurely rule-of-thumb method of adjusting cutters in the boring bar, nor is this means sufficiently accurate for modern work. An average of 33 per cent of time may be saved by means of the Casler Offset Boring Head in boring jigs, fixtures and other work more convenient to hold stationary than to rotate.

**THE CASLER OFFSET BORING HEAD**

also reduces the number of tools required to bore holes accurately to size, as the range of each is four times the offset of the boring head plus the capacity of the tool at center. Adjustment is made by means of a screw with micrometer graduations to 0.001", and a socket wrench.

**Boring Bar May Pass Clear Through the Head.**



**Complete Description in Catalog.**

## MARVIN & CASLER CO.

CANASTOTA NEW YORK, U. S. A.

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**The Chuck That Never Slips.**

**The More You Crowd It, The Tighter It Grips.**

**NARRAGANSETT MACHINE CO.**
**PROVIDENCE, R. I., U. S. A.**

---

A STEP FORWARD IN AIR CHUCK DESIGNS

# LOGAN

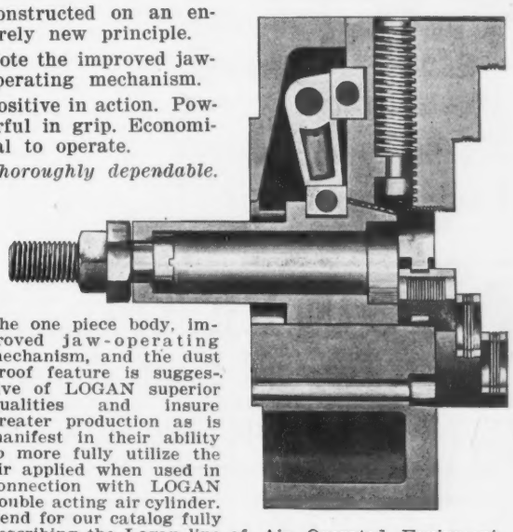
## AIR OPERATED CHUCKS

Constructed on an entirely new principle.

Note the improved jaw-operating mechanism.

Positive in action. Powerful in grip. Economical to operate.

*Thoroughly dependable.*



The one piece body, improved jaw-operating mechanism, and the dust proof feature is suggestive of LOGAN superior qualities and insure greater production as is manifest in their ability to more fully utilize the air applied when used in connection with LOGAN double acting air cylinder. Send for our catalog fully describing the Logan line of Air Operated Equipment.

**FRANK G. PAYSON CO.**
**9 South Clinton St., CHICAGO, ILL., U. S. A.**
**Manufactured by Logansport Machine Co., Logansport, Ind.**

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## If You want the best Lathe or Drill Chucks—buy Westcott's

Little Giant Auxiliary Screw Drill Chucks, Little Giant Double Grip Drill Chucks, Little Giant Improved Drill Chucks, Oneida Drill Chucks, Spur Geared Scroll Combination Lathe Chucks, Scroll Combination Lathe Chucks, Spur Geared Scroll Universal Lathe Chucks, IXL Independent Lathe Chucks, Cutting-off Chucks.

Spur Geared Scroll Combination Lathe Chuck

**Strongest Grip, Greatest Capacity Great Durability and Accuracy**

**WESTCOTT CHUCK CO.**
**ONEIDA, N. Y., U. S. A.**

*Ask for Catalogue*

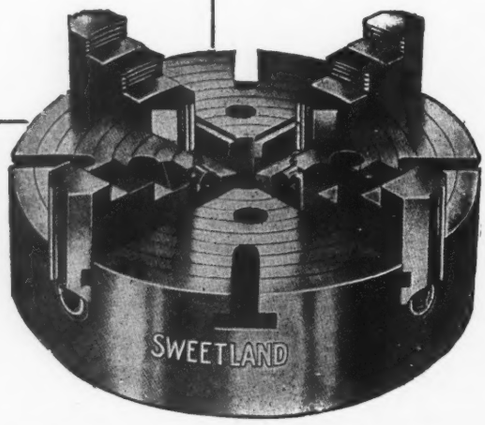
## *Hold On!*

An American ought to hold on to his Liberty Bonds. And a chuck ought to hold on to its work. There are two morals in this. Every time you order Sweetland Chucks you obey one of them.

# SWEETLAND LATHE CHUCKS

Strong, safe, simple chucks that last long and give utmost satisfaction as long as they last.

Buy them, if only on this count: In gripping, a Sweetland Lathe Chuck distributes the strain over the dovetail—*and not on the screws.*



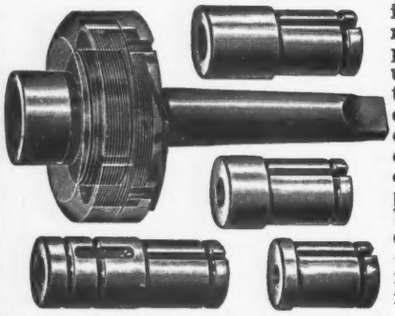

***Catalog 11-C will help you in ordering. Send for a copy to-day.***

***Chucks***
***Dies***
***Stamps***
***Tools***

**HOGGSON & PETTIS MANUFACTURING CO.**

**New Haven Connecticut**

## The Safety Drill and Tap Holder



is the only attachment for the purpose that gives universal satisfaction and is unequaled in efficiency, convenience, rapidity, accuracy and simplicity. Nothing to break or get out of order. Made in 4 sizes, covering from 0 to 2½ inches diameter.

**The Beaman & Smith Co.,** PROVIDENCE Rhode Island

## TAPS AND REAMERS

**First-class Tools and Prompt Deliveries**

**REIFF & NESTOR CO., Lykens, Pa.**

**1874 TRUMP DRILL CHUCK 1919**

We have been making it for 45 years; it is still the BIG Chuck at the SMALL price; for Straight or Taper Shank Drills.

| Three Sizes | No. 1 | No. 2 | No. 3 |
|---|---|---|---|
| | 0 to ⅛" | 0 to ¼" | 0 to ⅜" |

***Write for prices and particulars***

**TRUMP BROS. MACHINE CO. Wilmington, Del.**

**T-W**
INDEPENDENT LATHE CHUCKS

Twice the strength,
Twice the wear,
Twice the satisfaction is what the double rib construction and the T-W workmanship mean to chuck users.

***Send for a catalog***

**TerKelsen & Wennberg**
*Manufacturers of T-W Chucks*
**326 A Street**
**Boston, Mass.**

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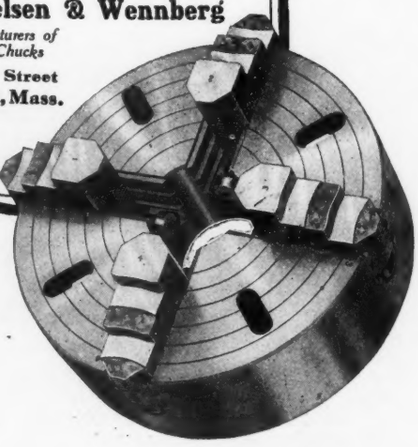


*Any Hole—any Good Tap—but only the*

# WOODSTOCK Tapping Chuck

## *Because—*

the "Woodstock" is uniformly dependable. It slips *before* the danger point is reached—not sometimes but always. This guarantees the safety of any standard tap, in any kind of a hole, in all classes of metal.

Tell an old-timer that a boy can tap blind and shallow holes as well as he and he won't believe it until you show him the simple, foolproof mechanism of the Woodstock Tapping Chuck.

***Details on request***

***See it in action—try one for 30 days at our expense.***

**PETER BROS. MFG. CO.**
135 Railroad Ave. ALGONQUIN, ILL.

# *A Big Advantage in the New Parallel Grip*

The American Pneumatic Chuck has a new parallel grip, which permits work to be held with same pressure for its full length, irrespective of diameter variations up to ¼″ or of a taper on the work. Hinge pins are not subjected to strains, as the draw rod pulls directly on jaws. Pin holes, thus, are not likely to become elongated, and cause inaccurate jaw alignment.

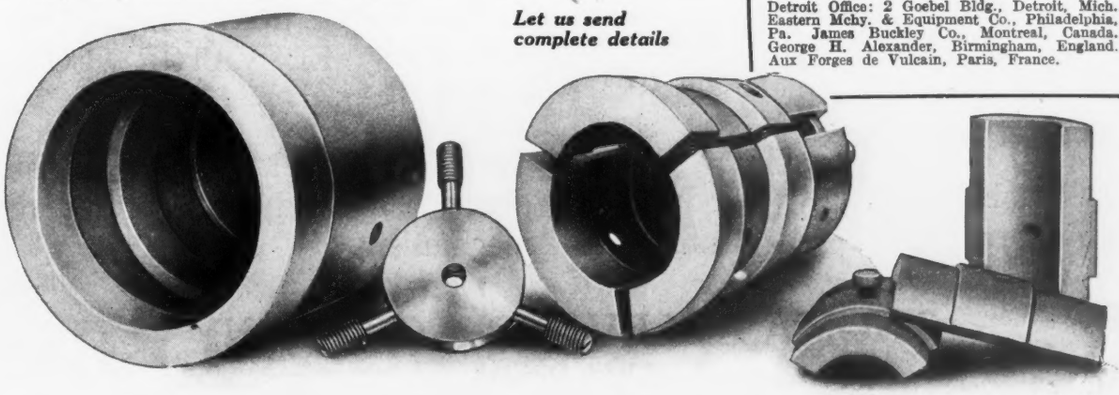
Made with open end for bar work. Three jaw chuck in 2″, 3″, 4″ and 5″ sizes. Two-jaw, four-jaw and special capacity chucks made to order.

MANUFACTURED BY THE
**American Pneumatic Chuck Co.**
CHICAGO ILL., U. S. A.

SELLING AGENTS
**NEIDOW & PAYSON COMPANY**
9 So. Clinton Street
CHICAGO ILL., U. S. A.

Detroit Office: 2 Goebel Bldg., Detroit, Mich. Eastern Mchy. & Equipment Co., Philadelphia, Pa. James Buckley Co., Montreal, Canada. George H. Alexander, Birmingham, England. Aux Forges de Vulcain, Paris, France.

***Let us send complete details***



# THE AMERICAN PNEUMATIC COLLET CHUCK

# THE BARKER WRENCHLESS CHUCK

## *Chuck Instantly*

### *—Whether the lathe is turning or still—*

THE BARKER WRENCHLESS CHUCK entails no paraphernalia. It is complete in itself.

Its enormous gripping power fits it for the very heaviest duty, while its nearly frictionless construction maintains an intimate touch between the operator and the cut, on lighter work.

Its instantaneous, self-centering grip and release turn into actual production that time which is otherwise expended in wrench work and adjusting.

It keeps the lathe always turning against a cutting tool.

It is increasing lathe production all over the United States, as shown by a continuous stream of testimonials.

The Spicer Manufacturing Company, South Plainfield, New Jersey, reduced their chucking time 50 per cent through use of the BARKER WRENCHLESS CHUCK.

It permits bar work, is easily fitted to or removed from any standard lathe, and by virtue of its construction will last for many years.

It is made where it was developed and perfected, in the shops of the THOMAS ELEVATOR COMPANY.

Send for booklet with prices, full description and illustrations of mechanism.

TECD-5

**THOMAS ELEVATOR COMPANY**

**Chuck Division**

**28 South Hoyne Avenue Chicago, Illinois.**

**Branch Office: 328 Park Row Bldg., New York, N.Y.**

THE PIECE-WORKER SAYS—

"GIVE ME WEAR-EVER TAP CHUCKS"

# The Pay Envelope Shows Why

Right tools mean good work, good work means more money and contented workers who *stay* on the job.

Wear-Ever Tap Chucks further quick, accurate work that gives all-round satisfaction. Whether you pay your help by the "piece" or "week," *their* wage and *your* profit depend on the quality and quantity of production.

Wear-Ever Tap Chucks make accurate chucking a matter of course; they save taps, speed up work and don't get out of order. They are simple in design, easy to use; the first cost is small and they give a straight, positive drive to any straight shank tool.

***Your men will appreciate them; you need them. Ask to see them at your dealers or write us for a sample chuck.***

**SCULLY-JONES & COMPANY**

**647 Railway Exchange Bldg.** **CHICAGO, ILL., U. S. A.**

# Steel Reenforced Lathe Chucks

SEE THAT STEEL RING

Durable — Economical

## *Answer This!*

Wouldn't you buy a case of 100 proof Bourbon at the same price as a case of 2¾% Beer?

**WELL**

Our Steel Reenforced Lathe Chucks are the same price as Iron Body Lathe Chucks

**AND**

For the differences in strength, refer to the two beverages mentioned above.

**PRATT CHUCK CO.,** MAIN OFFICE FRANKFORT, N.Y.

Factories: FRANKFORT, N. Y. ONEIDA, N. Y.
NEW YORK Sales Office and Stockroom: 39 CORTLANDT ST.,
CHICAGO Sales Office and Stockroom: 557 W. MONROE ST.

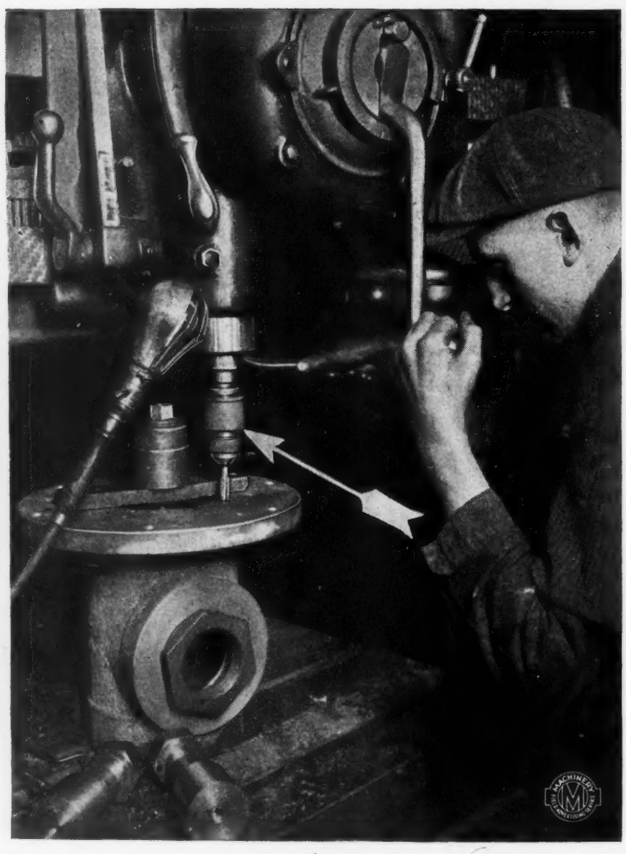
# "DOUBLE GRIPP"
## Safety Tapping Chucks

WILLIAM L. PROCUNIER · THE DOUBLE GRIPP · CHICAGO, ILL.

**SAVE TAPS—
SAVE TIME—
TAP THE HOLE
STRAIGHT—
EVERY TIME**

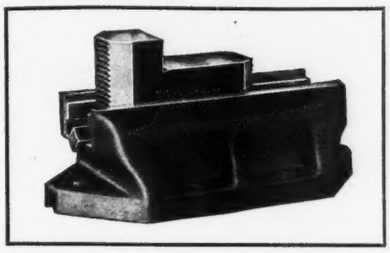
*WHERE TAPS WEAR OUT BUT NEVER BREAK*

Safety Tapping Chucks are standard equipment in the Keystone Driller Company's shop at Beaver Falls, Pa. Most of the work tapped consists of brass, cast-iron and steel parts for oil well pumps and engines—wrist pins, base plates, crossheads, pipe fittings and cylinders up to 18″ diameter. Taps from 5/16″ to 7/8″ are used on this work—used hard, until they are worn out. Broken taps? They don't know the meaning of the word.

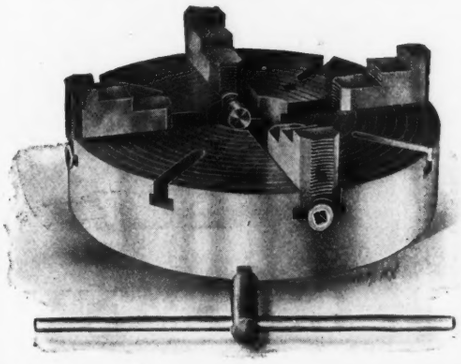


**William L. Procunier**
**549 W. Washington Blvd., Chicago, Ill.**
New York Representative: Young, Corley & Dolan, Inc., 115 Broadway, New York City.

# HORTON for CHUCKS



*Send for Catalogue 16, which lists our entire line*



AN inclusive line gives a wide choice of styles and sizes. Horton Chucks include steel, iron and combination chucks—from the Horton-Morrow Drill Chuck to the big Horton 42″ car wheel chuck. The upper cut shows Horton Face Plate Jaws—steel or iron—made in sizes from 4″ to 14″, for use interchangeably on different face plates with special provision for convenient rigid attachment.

The Horton All Steel Independent Lathe Chuck is designed to withstand severe service without deterioration.

No matter what your need—there's a Horton Chuck to fill it.

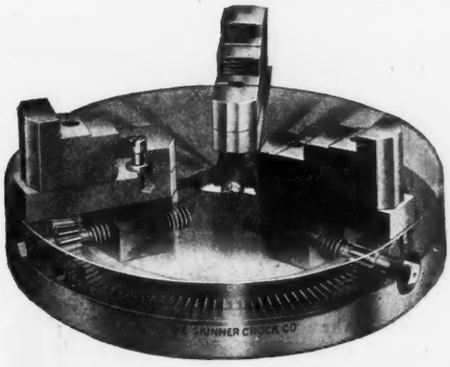
**THE E. HORTON & SON CO.**

**WINDSOR LOCKS CONNECTICUT**

# SKINNER

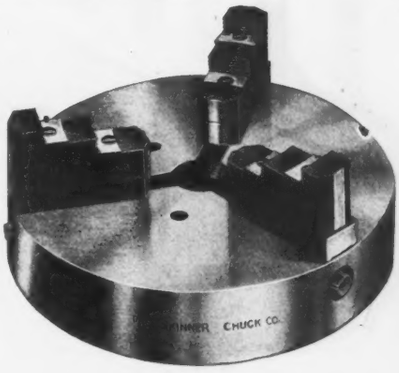
## GEARED SCREW CHUCKS

***Universal and Combination 3-Jaw or 4-Jaw***



These powerful chucks, with extra heavy gearing, are distinguished for their accuracy and ease of operation. To reverse jaws simply loosen the jaw screws, turn the upper section end for end and tighten the screws again.

***May we send Catalog?***



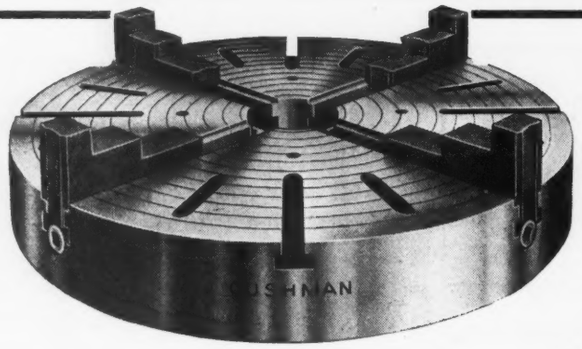
**THE SKINNER CHUCK COMPANY**

**Factory and Main Office** **NEW BRITAIN, CONN.**

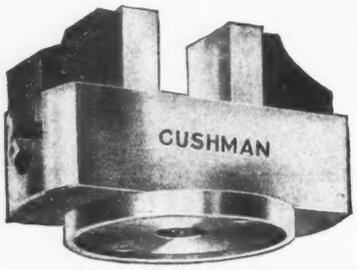
London Office, 139 Queen Victoria St. San Francisco Office, Rialto Bldg. New York Office, 94 Reade St.

# CUSHMAN CHUCKS

**Drill Chucks**
**Lathe Chucks**




**Portable Face-Plate Jaws**




It takes time to make good chucks.
It takes time to train men to make them right.
We've been 57 years making Cushman Chucks.
We've made every one of those years count.
We've got every chuck in stock that you need in your plant.
State your requirements.

## THE CUSHMAN CHUCK COMPANY

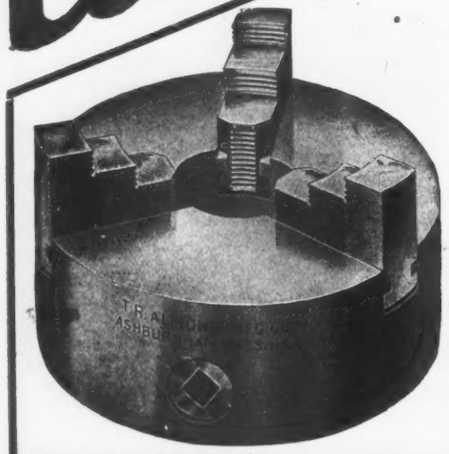
**HARTFORD** **CONN., U. S. A.**

*Forty Years of Progress*

# Almond

**Lathe and Drill Chucks and Micrometer Calipers**

Almond Micrometers have been perfected to the point where they are comparable only with Johansson Gages for accuracy. Made in English and Metric Measurements.



**Direct Drive Gear Nut Drill Chucks** have hardened pinion bushings and other exclusive "Almond" features. Almond Lathe Chucks, one piece body, economical to operate. Details on request.

## T. R. Almond Mfg. Co.

**Ashburnham** **Mass., U. S. A.**

# M.E.C.
## Air-Operated
# Chucks

### Selected Because of Their Powerful Grip

The distinctive saving in chucking time which characterizes M. E. C. Air-Operated Chucks takes second place in the operation here illustrated. A heavy roughing cut is taken in the forged steel ring, 19¼″ diameter, and the problem was to get a chuck that was positive as well as fast.

The machine, a high power production lathe equipped with cutter of high speed steel, is being pushed to capacity; but the work never slips or wavers in spite of the heavy cut. Held in the powerful grip of an M. E. C. Three-Jaw Air-Operated Chuck it cannot slip.

M. E. C. Chucks insure top-notch production, save chucking time and permit operating machines to capacity. They are easy to control, which saves the operator's energy, and increase output 30 to 50 per cent on every installation.

***M. E. C. Three-Jaw Chucks have advantages worth investigating***

## MANUFACTURERS EQUIPMENT COMPANY

**Waller and Fillmore Streets** **CHICAGO, ILL., U. S. A.**

NEW YORK OFFICE: Woolworth Bldg., New York City.
AGENTS: J. R. Stone Tool & Supply Co., Detroit, Mich.; Thomson Tool & Supply Co., Indianapolis, Ind.

# JACOBS
## DRILL CHUCK

"Known throughout the world."

IT'S easy and convenient to open and close them quickly — requiring a mere twist of the wrist with the ever-ready key.

They hold drills firmly and accurately on center. Their working qualities are unsurpassed. Their proven superiority is the reason why they are so universally found in modern shops throughout the world

JACOBS MFG. CO. HARTFORD CONN.

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## *A "Purple Patch" on*

a pair of pink trousers would be out of place. Wouldn't it?

Yet a shop owner will often use a misfit tool, SIMPLY BECAUSE HE HAS IT. It usually shows in the cost of the finished work.

"Ain't it the truth?"

## THE ETTCO DRILL CHUCK

is a particularly adaptable tool. Needs no key, yet may be manually tightened if desired. Drives straight shank drills without slipping.

One-piece, dust-proof body and four other parts are all that are used in entire construction. No projections. Ball bearing.

**EASTERN TUBE & TOOL CO.**
INCORPORATED
41-59 Gardner Avenue Brooklyn, N. Y.

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## The Newman Multiple Rotary Chuck

Keeping a good tailstock turret on hand is first-class output insurance. If one of your big turrets is down for repairs or production lags on any other multi-operation work, the "Newman" can be depended on to meet the emergency.

Takes less than 15 seconds to attach to the tailstock of any engine lathe and has capacity for drilling, reaming, tapping, etc., up to 1½ inches.

**Newman Manufacturing Company**

*Established 1882*

**717 Sycamore Street**
**Cincinnati, Ohio**

TEN DAYS' FREE TRIAL

*DETAILS ON REQUEST*

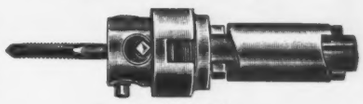
Graduated Adjustable Friction Self-Centering

# Tap Holder for Turret Lathe

*TAPS STEEL as Safely as Cast Iron*

Regulates the Whole Power of Machine to Just Drive, but Cannot Break Tap. When Tap Sticks (or Strikes Bottom) the FRICTION SLIPS, and Tap can thus be Run In and Out until the Toughest Metal is Quickly Tapped.

Interchangeable Spring Shank for Rough and Finish Taps occupying One Turret Hole.

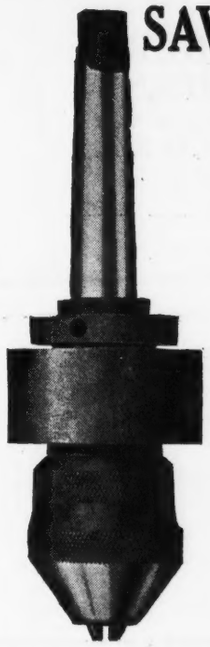


Double-Clutch Sleeve

Especially Good for Roughing and Finishing Taps, Running Solid Dies Up Against a Shoulder, etc.

**ERRINGTON**
MECHANICAL LABORATORY
39 CORTLANDT STREET, NEW YORK
136 West Lake Street, Chicago
New England Branch: 829-A Old South Building, Boston, Mass.
Catalog Francais: Edgar Bloxham, Paris
12 Rue du Delta

# BICKNELL-THOMAS FRICTION TAP CHUCKS SAVE TAPS



With sufficient power to drive taps under all ordinary conditions, the friction drive of the Bicknell-Thomas Tap Chuck slips when unusual strains threaten trouble.

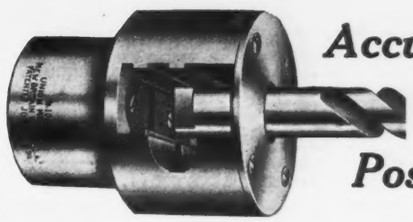
Their construction insures *durable* accuracy, the compact design makes them especially valuable on multiple spindle machines.

*Made in four sizes—1/8" to 1". Straight or Morse Taper Shanks.*

*Send for the circular*

**BICKNELL-THOMAS COMPANY**
GREENFIELD, MASS.

# *UNION* Drill Chucks



*Accurate and Positive*

An all-around, general purpose drill chuck that can be depended on to drive any kind of a drill in any kind of stock. Accurate, positive and constructed to "Union" standards, this chuck is made in seven sizes—0 to 2 inches—and is provided with patent transverse slot to take drills with tenons.

*Catalog Lists Full Line*

**Union Manufacturing Co.**
New York Office: 26 Cortlandt Street
**New Britain, Conn., U.S.A.**
MAKERS OF A COMPLETE LINE OF CHUCKS

Keep yourself informed of the latest developments.

Send for Catalog 206M.

# "D & W" Service is Progressive

"D & W" Magnetic Chucks are equipped with a variety of auxiliary plates to be used as jigs or fixtures for holding odd shaped work and with end and side stops and a vertical attachment for mounting the chuck perpendicular to the machine table. We also make taper and swiveling magnetic chucks and are constantly perfecting additional facilities for broadening "D & W" Chucking Service.

**D & W FUSE COMPANY, Providence, R. I.**

# GRANT GEARS

IRON, FIBRE, STEEL, BRASS, RAWHIDE

Grant experience covers every phase of gear production; Grant facilities are equal to any demand; Grant deliveries are prompt, and most important just now, Grant prices are right.

A dependable source of supply, from which uniform gears may be had at any time, is an asset for any smooth-running plant. Grant Gears will keep yours going without a hitch. Send a trial order. Ask for latest catalogue.

**GRANT GEAR WORKS**
INCORPORATED
151 PEARL STREET, BOSTON, MASS.

# FORGED GEAR BLANKS

Strong, durable, dependable—better than castings and frequently less expensive — forged gear blanks have practical advantages for all classes of mechanisms, as evidenced by regular repeat orders from manufacturers in every line. Fall in.

ESTIMATES FURNISHED PROMPTLY
ANY SIZE, STYLE AND QUANTITY

**THE MACHINERY FORGING COMPANY**
Hamilton Avenue and Marquette Street
CLEVELAND, OHIO, U. S. A.

# HINDLEY GEARS

Whatever you make, if you use gears, it will pay you to specify "Hindley Gears." A greater-than-ordinary number of teeth in contact and consequently greater bearing surface make Hindley Gears the logical choice for high speeds and heavy pull.

*Thirty-nine Years on the Market*

*Specify "Hindley" on your next order*

**Hindley Gear Company**
1105 Frankford Avenue Philadelphia, Pa.

# EARLE GEARS

## A Sign of Good Gears

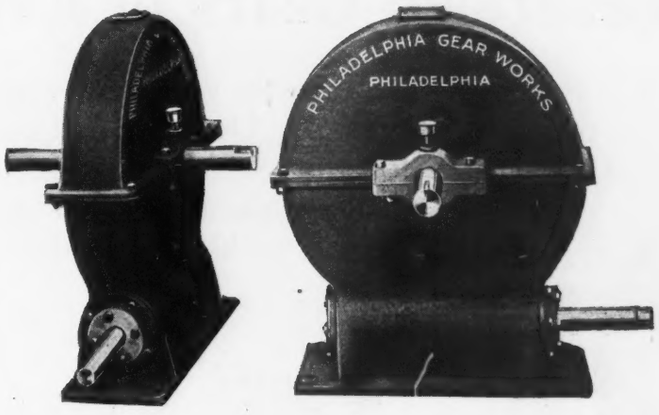
*Gears all Sizes— Almost all Kinds*

We make large and small gears of steel, brass, bronze, cast iron and other materials. Our plant is equipped with up-to-date machines, managed by long experienced men.

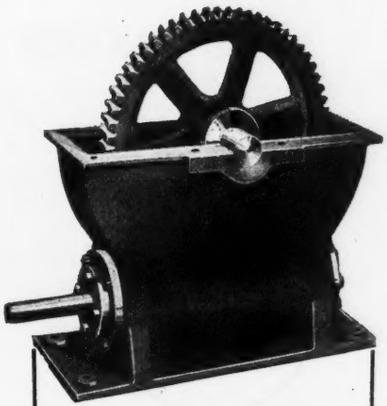
We also heat treat gears. Good deliveries—attractive prices. Write us.

**The Earle Gear & Machine Co.**
4705 Stenton Avenue, Philadelphia

# PHILADELPHIA
## Worm Gear Units




## We're Making These Units With Either Ball or Plain Bearings



*Send your specifications, and be sure to ask for our new catalogue.*

To assure our customers long and efficient service from our worm gear drives, we are prepared to supply housed worm gear units complete—worm, gear and housing fully assembled and tested—all ready to set up.

Centers are accurately fixed and there is no possibility of gears getting out of alignment with the consequent power loss due to excessive friction.

These housings are furnished with plain or roller bearings according to the nature of the service required and with the worm either above or below the gear.

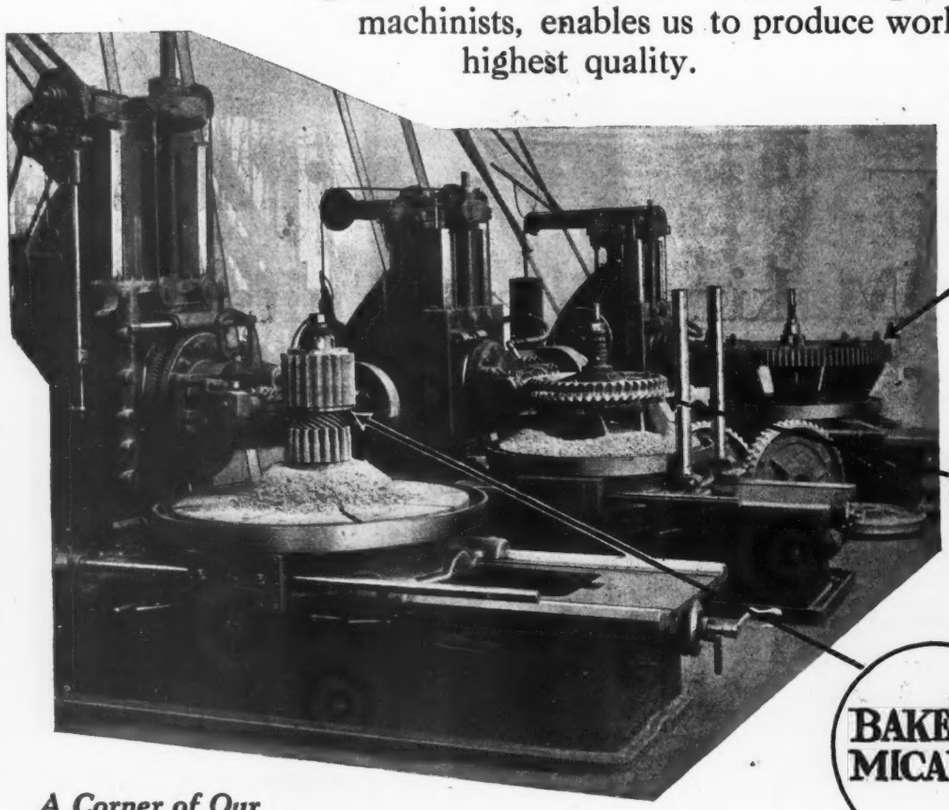
Ample lubrication is provided for in either case and smooth, silent, economical operation is assured.

Philadelphia GEAR Works 1120-1128 Vine St. Philadelphia

# JONES

## Generated Gears of Every Description

Your order for one gear will receive as careful attention as an order for a hundred. Our large and completely equipped plant, together with our force of skilled engineers and machinists, enables us to produce work of the highest quality.



CAST STEEL

BRONZE

BAKELITE MICARTA

*A Corner of Our Gear Hobbing Department*

**Jones Service + Jones Quality + Jones Prices = Your Order**

W. A. JONES FOUNDRY AND MACHINE CO.

MEMBER OF AGMA

*Established 1890*

4409 West 12th. Street, Chicago Illinois U. S. A.

New York Office: 30 Church Street

# Gear noises are positive proof of power loss, vibration and harmful wear

## To tolerate them is costly, dangerous and inconsiderate

## NEW PROCESS RAWHIDE PINIONS

***by quieting noisy metal-to-metal drives add surprisingly to savings, safety and comfort***

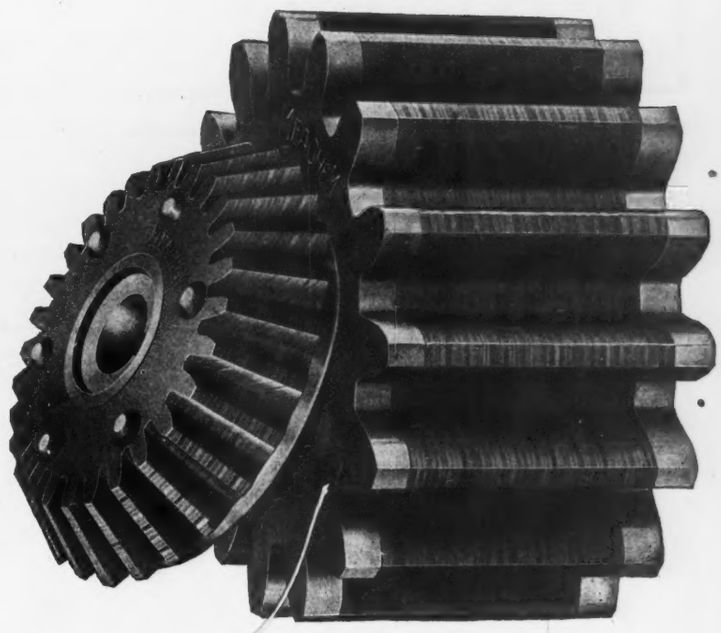
The resilient rawhide teeth cushion the gears and smoothen the action of all driven members. Parts wear longer, delicate alignments are preserved and machine life and the ability to turn out a high quality product greatly lengthened.

The grateful relief from preventable noise allows the operator to concentrate his mind on the work before him. By protecting him from brain fag, he is helped to avoid mistakes, his willingness is stimulated and his endurance increased.

The absorption of shock by the rawhide materially lessens the danger of stripping teeth, especially on the large, expensive companion gears.

The elimination of distracting noise makes the operator alert to detect danger and escape accident.

Try a *new process* RAWHIDE PINION on some lathe, press, shear, air compressor, or high speed motor where noise and wear are worst—at least send for and read our booklet "Noiseless Gear Driving."



***Metal Gear Cutting in Your Shop is Costlier Than Gear Buying From Us***

When you buy from us you can demand perfection, and there won't be any tendency to put out gears on your product that are barely good enough to "get by," just because you spend the money for making them yourself and have to cash in on this expense. We can furnish accurately cut metal gears on a quantity basis and at prices better than your fondest hopes. Send us specifications or blue print for estimate.

## THE MEACHEM GEAR CORPORATION

Sole manufacturers of *new process* RAWHIDE GEARS and PINIONS—still made under the direction of the inventors and the men responsible for every stage in their development.

CANAL STREET & WEST SHORE R. R. SYRACUSE, N. Y.

22

# "SPIRO" COMPRESSION COUPLINGS

## *The Joint is As Strong As the Rest of the Shaft*

Are you installing new shafting? Do you wish to lengthen your present shafting? Never mind if your stock isn't long enough. Remember a "Spiro" joint will stand the same torsional strains as the rest of the shafting.

See the illustration; the ends of sleeve "A" lead into outer and inner shells "B" and "C" respectively.

When the two shaft ends are brought together by the tightening of the bolts the sleeve "A" with its spiral slot just "wraps itself around" them with such strength that it's safe to list the whole outfit ever afterwards as one piece. Get informed.

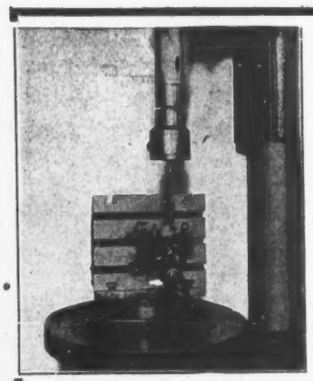
**Complete description of "Spiro" and other Bond Transmission Appliances in Catalogue 38-M.**

***Ask us for it when writing.***

## BOND FOUNDRY & MACHINE COMPANY

**MANHEIM, LANCASTER CO.** **PENNSYLVANIA, U. S. A.**

Associated Companies: Charles Bond Co., Philadelphia, Pa.; J. & G. Rich Co., Philadelphia, Pa.; Christiana Machine Co., Christiana, Pa.; Bond Engineering Works, Limited, Toronto, Canada.



DRILLING twelve holes at various angles without removing the work from the fixture is not a stunt. To prove it we are showing photographs of the way it was handled with the

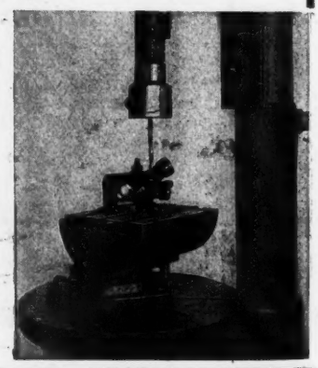
## UNIVERSAL ANGLE PLATE

### A PRECISION TOOL

***Make Your Machines Universal Also***

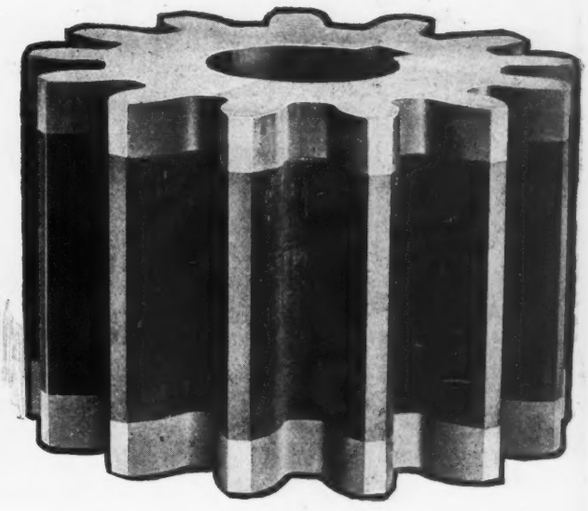
Accurate, well constructed and graduated to 5 minutes or closer, this fixture makes milling machines, drills, planers and shapers practically universal. Good for toolroom and shop.

Made in sizes to cover a wide range of work with holding surfaces from 4″ x 6″ to 12″ x 18″, weight 16 to 440 pounds. Special bases for special machines can be supplied at extra cost.



## Boston Scale & Machine Company

**100 Ruggles St.** **BOSTON, MASS.**



## No Variation in Two Years

The micrometer tells the story. Conditions so detrimental to ordinary non-metallic gears fail to make any impression on

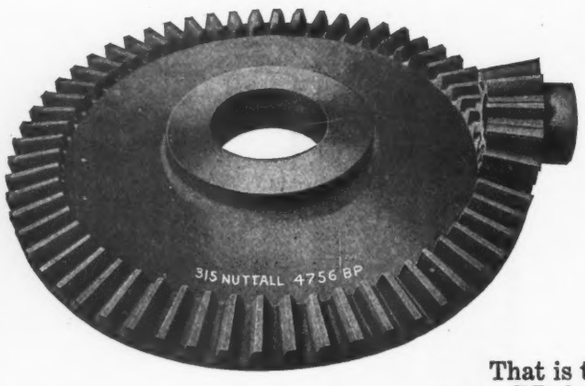
## Fabroil Gears

Their dimensions and shape remain unchanged no matter how long you keep them in stock. Fabroil Gears will fit the shaft and mesh precisely and accurately after years of storage even though they have been subjected to varying degrees of heat, cold, dampness or dryness.

6081

**General Electric Company**

General Office Schenectady, N.Y.




# Years of Service and no Gearing Replacements Necessary

That is the BP record of service. For over twelve years BP heat treated gearing has been constantly getting the economical results that machine manufacturers and mill operators are striving for.

NUTTALL BP heat treated gearing is guaranteed to last four times as long as untreated standard cast steel gearing in identical service and it does—usually more.

The cost of a BP heat treated gear is only slightly in excess of the cost of one of the "one-fourth as good" standard cast steel gears.

*Get our Heat Treatment Booklet today*

MEMBER OF AGMA

**R. D. NUTTALL CO.**
Pittsburgh, Pa.

# Nuttall Gears

EVERY GEAR REGISTERED

# BOSTON GEARS

## The World's Standard

**1200 Sizes to Select from** **Best Quality—Low Cost** **300,000 in Stock**

*IMMEDIATE DELIVERY from the following STORES*

| | |
|---|---|
| BOSTON, Mass.....Chandler & Farquhar Co. | INDIANAPOLIS, Ind.....Vonnegut Hardware Co. |
| BUFFALO, N. Y.....Root, Neal & Co. | MILWAUKEE, Wis....Phillip Gross Hardware Co. |
| CHICAGO, Ill.....Samuel Harris & Co. | NEW YORK CITY..Patterson, Gottfried & Hunter |
| CINCINNATI, Ohio.....Queen City Supply Co. | PHILADELPHIA, Pa.....Charles Bond Co. |
| CLEVELAND, Ohio, Strong, Carlisle & Hammond Co. | PITTSBURGH, Pa.....Somers, Fitler & Todd Co. |
| DAYTON, Ohio.....Patterson Tool & Supply Co. | SAN FRANCISCO, Calif.....C. W. Marwedel |
| DETROIT, Mich.....Charles A. Strelinger Co. | ST. LOUIS, Mo...Schroeter Brothers Hardware Co. |

**CHICAGO BRANCH, 623 W. Washington Boulevard, Chicago, Illinois**

*Send for 1919 catalog containing complete specifications of all gears, chains, radial and end thrust ball bearings and universal joints, also many pages of valuable tables and information.*

*GEARS TO ORDER IN LARGE QUANTITY A SPECIALTY, SEND FOR ESTIMATE*

**BOSTON GEAR WORKS,** MAIN OFFICE AND FACTORY NORFOLK DOWNS, (QUINCY) MASS.

DETAILED INFORMATION ABOUT OUR PRODUCTS ON FILE AT ALL THE NATIONAL RED BOOK SERVICE STATIONS ONE IS LOCATED NEAR YOUR OFFICE

# Meisel Gears

MP REG.

# Good Service

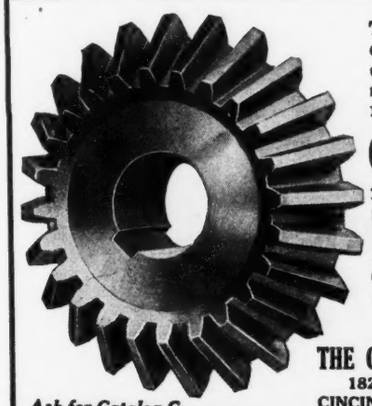
MEMBER OF AGMA

Meisel Gears have a reputation founded on good service. Quality, workmanship, delivery and price are all aimed to make satisfied customers, and the size and number of our regular repeat orders indicate that we are a pretty good shot. But, we want to prove it to *you* on *your work*.

We are also equipped for Heat Treating, Broaching, Contract Work, Case Hardening, Tooth Rounding, Splining, Grinding—Internal, External—and Screw Machine Work up to 5½ Inches.

***Let us estimate on your requirements.***

**MEISEL PRESS MFG. CO., 948 Dorchester Ave., Boston, Mass.**



The importance of correctly cut, high quality gears can scarcely be overestimated.

## Cincinnati Gears

made to your specifications are of the best material, carefully inspected, and delivered when promised.

*Try them.*

**THE CINCINNATI GEAR CO.**
1827-1833 Reading Road
CINCINNATI OHIO, U. S. A.

*Ask for Catalog C*

**Cut Gears, Racks, Worms, Worm Gears, Special Machinery**

**The SIMONDS MFG. COMPANY**
PITTSBURGH PA., U. S. A.
"TRY SIMONDS"

**BEVEL GEAR GENERATORS.**
**BEVEL GEARS**
CUT THEORETICALLY CORRECT.
Special facilities for cutting Worm, Spiral, Miter, Internal and Elliptical Gear Wheels.
**The Bilgram Machine Works,**
1231 Spring Garden Street, Philadelphia, Pa.

# STAHL GEARS

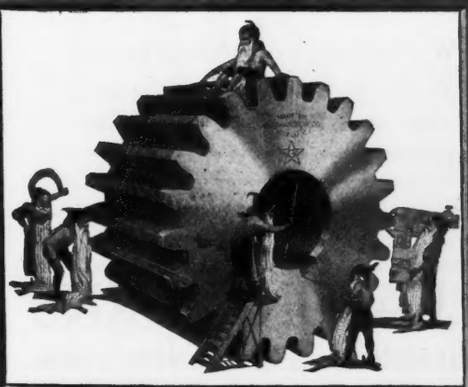
*Quality is Economy and Stahl Gear quality is true economy always.*

**RAWHIDE AND CUT METAL GEARS**

Metal Gears—spurs up to 60" dia., 2 D. P.; bevels up to 24" dia., 1¾ D. P.; spirals and herringbone gears up to 19" dia., 3 D. P.; worms up to 18" dia., 3 D. P.; racks 8' long 4 D. P. Rawhide gears—any requirement up to 15" dia., 2 D. P.

***LET US ESTIMATE***

**The Stahl Gear & Machine Co.**
1390 East 40th St. Cleveland, Ohio, U. S. A.



# GANSCHOW

"QUALITY"
RAWHIDE AND BAKELITE
PINIONS
WILLIAM GANSCHOW COMPANY
CHICAGO ILLINOIS

# AVOID THE RUSH

PLACE YOUR **ORDER** NOW AS

IT IS GOING TO BE DIFFICULT TO GET

# CROFOOT GEARS

FOR THE BIG BOOM IS NOW STARTING

BY ORDERING **NOW** YOU ARE

INSURING YOURSELVES AGAINST LATE DELIVERY

Trade Mark

## CROFOOT GEAR WORKS

INCORPORATED

31 AMES ST. Cambridge A Branch BOSTON, MASS.

Member American Gear Manufacturers Association

# Gleason Machines

*To Cut Your Gears--- Your Plant or Ours*

Gleason Bevel Gear Planers are accurate, well built, easily operated machine tools.

They are the choice wherever quality is the prime consideration.

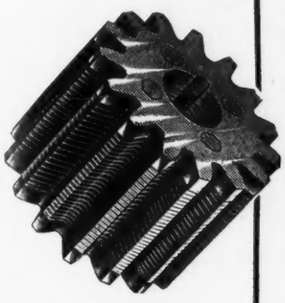
We will cut your bevel gears on these machines for you, —or we will sell you the machines.

***Write for further details.***

## GLEASON WORKS

ROCHESTER NEW YORK

# SILENCE!



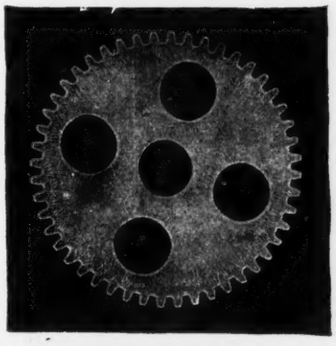
Silence means efficiency. You can't work well to the tune of crashing machinery—neither can your men. Specify Chicago Rawhide Gears in your next order—get silence in your plant.

If made of hide or leather for mechanical purposes—WE MAKE IT.

The products of our manufacture include Belting, Lace Leather and Cut Lacing, Hydraulic Packing, Rawhide Mallets and Hammers, Rawhide Gears, Leather Specialties, etc.

*We solicit your inquiries.*

**The Chicago Rawhide Mfg. Co.**
1301 Elston Ave. CHICAGO, ILL.



**GENERATED**
in our
**Gear Cutting Department**
(Cut is full size)

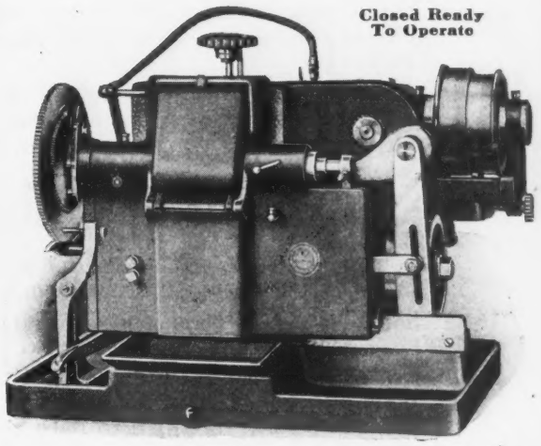
*Let Us Quote You*

**MEISSELBACH-CATUCCI MFG. COMPANY**
27 CONGRESS STREET NEWARK, N. J.

**GEARS**
SPUR—BEVEL—WORM
SPIRAL — RACKS
*Good Deliveries*
**TAYLOR MACHINE CO.**
Carnegie Ave. & 79th St.
CLEVELAND OHIO

**FAWCUS HERRINGBONE GEARS**
Mill Drives - Turbine Transmissions
Spur Gears - Bevel Gears - Worm Gearing
**FAWCUS MACHINE COMPANY. PITTSBURGH. PA.**

## A Highly Efficient "Automatic" for Cutting Small, Fine Pitch Gears

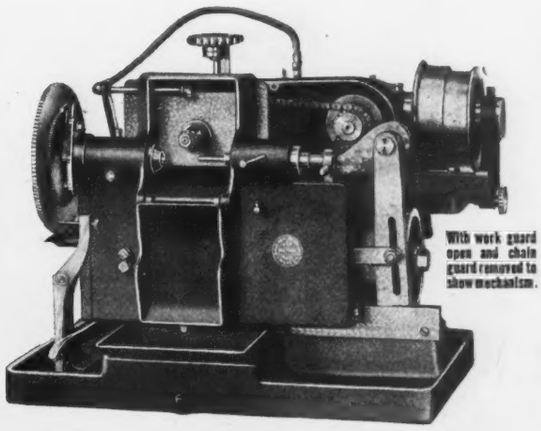



## The Waltham 4-Inch Gear Cutting Machine

A precision manufacturing machine for which power is obtained through two-step cone pulley by counter or motor—ball bearings being liberally used throughout the drive mechanism. Four speeds are available for the cutter spindle which is driven by silent chain and interchangeable sprockets.

Indexing mechanism is cam controlled. The cutter slide is securely clamped during the cutting operation and lifted during the return of the work slide and indexing.

*Base of Machine, 29" x 23"* *Details on Request*




**WALTHAM MACHINE WORKS**
Newton Street WALTHAM, MASS.

Small Thread Millers, Gear Cutters and other small Automatic Machines

## How About Your Machine?

Today, the man who buys machinery of any description is interested in the transmission—the truly vital part. He wants to know why your machine should particularly merit his attention—what it can do that other machines can't—why it is better than others he might buy for the same or less money.

In every machine the gears are of extreme importance. On them depends the accomplishment, to a large degree, of that machine's work. A gear breakdown means a stop. If you use gears cut from

## Carnegie Solid Rolled Steel Gear Blanks

you have an undeniable selling argument. The very name indicates the superiority of the gears cut from them.

**Solid**—not cast steel gears. Gears cut from these blanks will outwear cast steel gears three or four times.

**Rolled**—the process of rolling forces the best quality steel to the rim of the blank where the most severe strain is encountered. It also insures a close grained structure which to date has been impossible to produce in any other manner.

These are the gears you will use, if you are looking for quality and the longest service.

Just write to our nearest District Office for more information.

**Carnegie Steel Company**

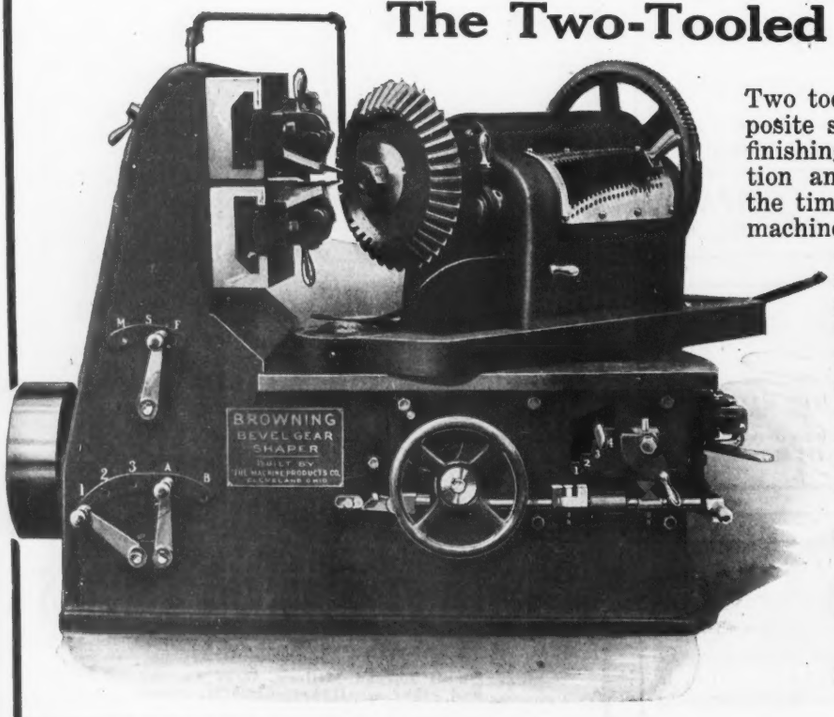
General Offices: Carnegie Building, Pittsburgh, Pa.

1283

*Double your Production of Bevel Gears with a*

# BROWNING AUTOMATIC GEAR SHAPER

## The Two-Tooled Machine

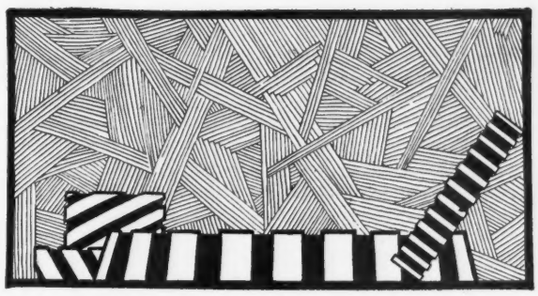



Two tools operate alternately on opposite sides of teeth, permitting the finishing of a gear in a single revolution and in approximately one-half the time required for finishing on a machine of the ordinary type. Tools correctly follow contours of revolving templets. There are no loose gears, nuts or wrenches. Blanks may be rapidly stocked out on the same machine. Capacity—gears to 24″, 2-pitch, any angle from 9° to 81°. Write for complete description today.

**THE MACHINE PRODUCTS CO.**

East 179th Street and St. Clair Avenue

CLEVELAND OHIO



IF gears of cheaper material can be used in the machines you manufacture in place of those of more expensive materials, of course you are willing to reduce your production cost.

In many cases, FOOTE Engineers have indicated where big savings could be made without a reduction in the efficiency or life of the machinery. It is because of their many years of experience in manufacturing gears and special machinery and because of their vast experience in advising machinery manufacturers, that FOOTE Engineers are able to render this money-saving service.

## Submit Your Problems to FOOTE

Our Engineering Service is yours without cost or obligation. Ask our advice on your gear problems. We may be able to indicate worth-while savings to you.

**FOOTE BROS. GEAR AND MACHINE CO.**

Manufacturers of Gears of all kinds

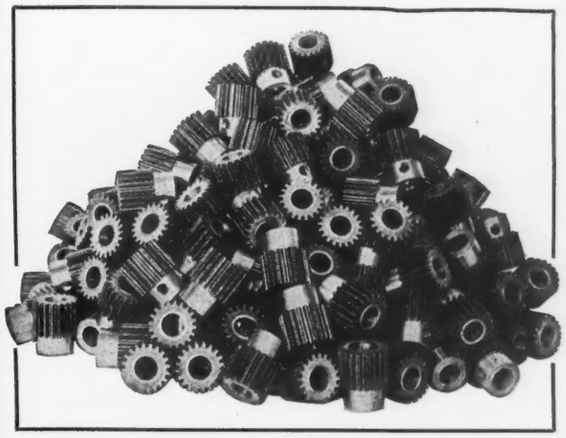
210-220 N. Carpenter St. and 211-221 W. Curtis St.

CHICAGO, ILLINOIS

*The Pinions in This Group Are Made of*

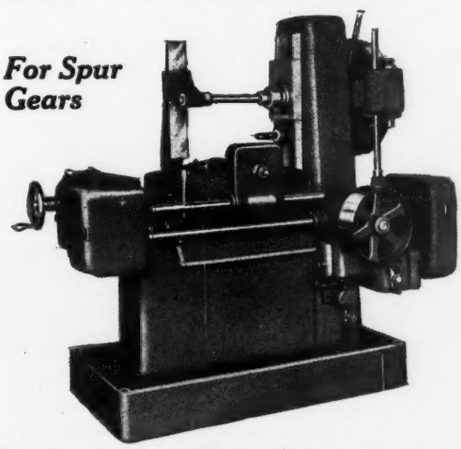
# BAKELITE MICARTA

the new composition which is being used extensively on high speed machinery, to insure a smooth, silent, economical drive.



# FLATHER AUTOMATIC GEAR CUTTING MACHINES

*For Spur Gears*



The improved "Flather" has eliminated the factor of chance from gear cutting. Sturdy in construction, yet delicately accurate, it operates with smoothness and certainty. Free from unnecessary complications; readily understood by the average workman. *Early Deliveries.*

**THE FLATHER MFG. CO.**

NASHUA N. H., U. S. A.

We Also Manufacture

# GEARS

**Gears and Pinions of "Peerless Rawhide" and Bevel Gears, Spiral, Worm, Spur, Internal and Herringbone Gears cut from Steel, Semi-Steel, Cast Iron or Bronze.**

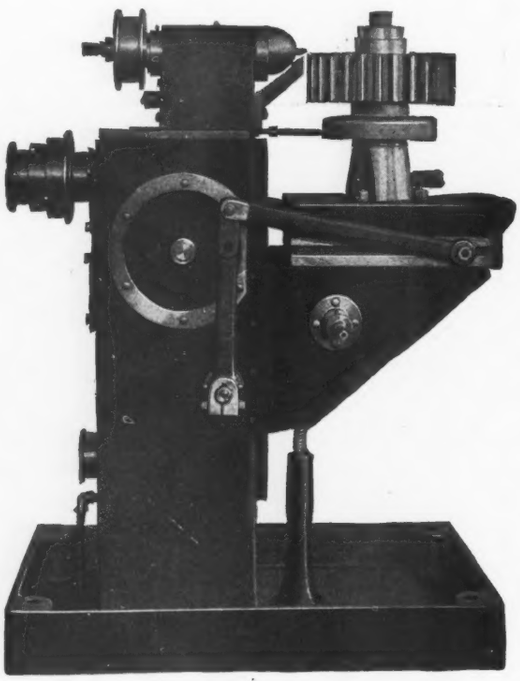
*Ask for our latest "Blue Book on Gearing"*

**THE HORSBURGH & SCOTT CO.**

CLEVELAND OHIO, U. S. A.

# CROSS

## GEAR TOOTH ROUNDING MACHINE



Its capacity is for gears up to 36 inches diameter—2-pitch or finer.

Rigidity is not obtained by the use of a block under the head and tail stock or by the attachment of numerous supporting arms.

Proper design does away with these makeshifts.

The gear is held absolutely rigid while the cutter oscillates in a perfect half circle over the end of the tooth.

No cams are employed to obtain this motion.

The Cross Gear Tooth Rounding Machine is the only machine that will successfully round tractor gears on a production basis.

The Cross Gear Tooth Rounding Machine is the fastest means known for the correct rounding of gear teeth.

It embodies many exclusive patented features, which permit extraordinary production.

In regular use this machine will round a ⅝ or ¾-pitch gear at the rate of 25 teeth a minute or a ⅘-pitch at 15 teeth per minute.

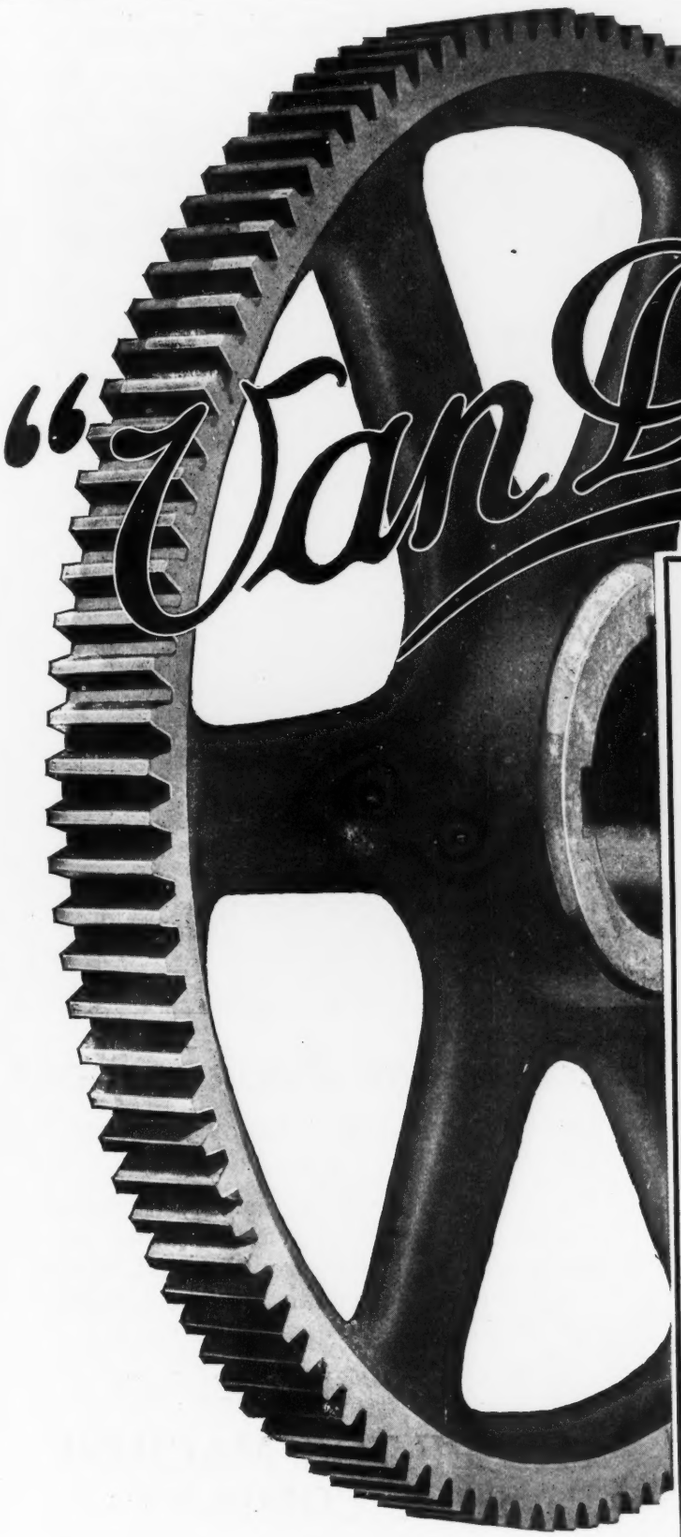
*Further details will be mailed upon request.*

"Round Corners on a CROSS."

The Cross Gear Tooth Rounding Machine is the original machine that allows the gear to be held rigid during the cutting operation, and where the cutter spindle oscillates about an axis eccentric to its own axis of revolution. All other machines having this principle are direct infringements, and all manufacturers, sellers and purchasers of the same will be considered direct infringers and will be held liable to the full extent of the law.

## CROSS GEAR & ENGINE COMPANY

809 Bellevue Avenue DETROIT, MICHIGAN




# GEARS

## that are made good to make good—and, they *do!*

Of course there are many good gears made, but one thing we are *sure* of, that the best material, workmanship and care procurable are combined in Van Dorn Gears, so you'll surely be *right* by using them.

*Write Dept. "M" for the whole story now.*

*It's really worth your while.*

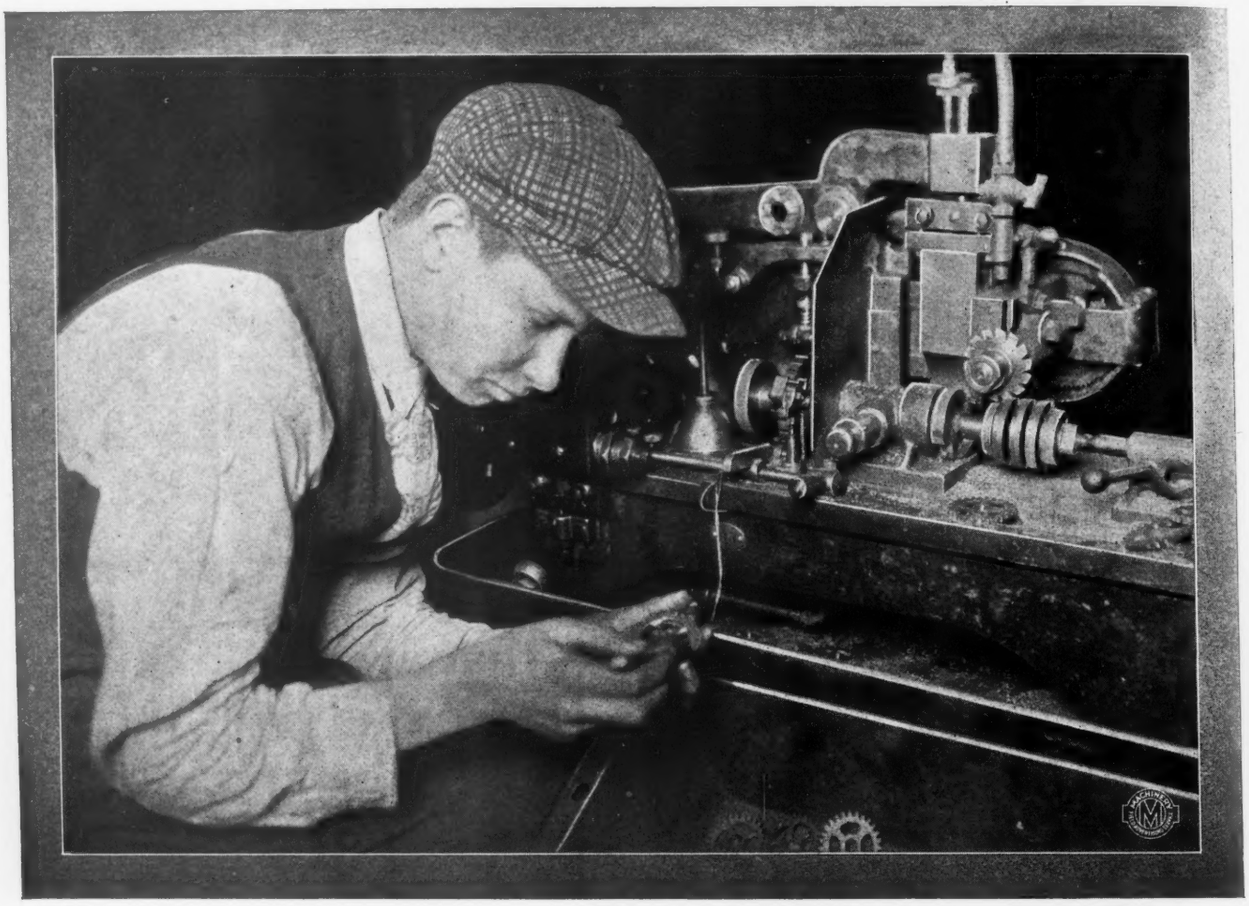
THE VAN DORN & DUTTON COMPANY

GEAR SPECIALISTS

CLEVELAND, OHIO

MEMBER OF AGMA

# BILTON GEAR MILLER The Simplest Gear Cutter Made



## *Bilton-Cut Gears for Mechanical Bookkeepers*

Here is a Bilton Gear Cutter which for the past year and a half has been doing but one thing—cutting cash register gears. When photographed it was working on six gears mounted on a 1/2" arbor. These gears are cast, three of brass and three of iron, and are mounted in pairs so that the cutter enters the brass gear first. This utilizes the stiffer cast iron blank to back up the softer brass. The iron gears have 7/32" faces, the brass 5/32" faces.

There are 1/4" spaces between the three pairs of blanks, making the total overall distance from outside of first blank to outside of last blank 1 5/8". These gears are 12 pitch and have 32 teeth. Production averages 4 sets—a total of 24 gears—per hour.

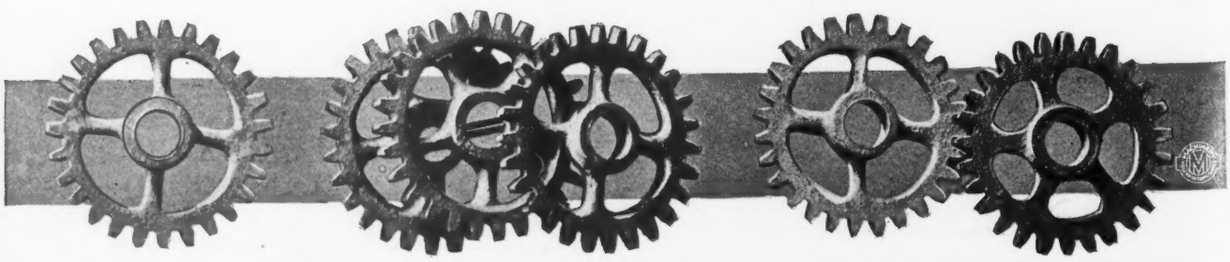
This Bilton Gear Miller has given perfect satisfaction since it was installed, has never been held up for repairs, and, in the opinion of the foreman, is "the simplest gear cutter made."

*Let us explain the reasons for Bilton Superiority. Write today for Catalog No. 20-G*

**THE BILTON MACHINE TOOL COMPANY**

**BRIDGEPORT CONN.**

Foreign Agents: Chas. Churchill & Co., Ltd., Alfred Herbert, Ltd.



# NEWARK

## GEAR CUTTING SERVICE

IF your requirements call for gears of exceptional size, remember that we're fully equipped to fill your orders. We specialize in the cutting of large worms, odd size gears of all kinds and special shapes. The men and equipment behind Newark gear cutting service give adequate assurance that materials and workmanship in *your* order will be of the best. Write for quotations.

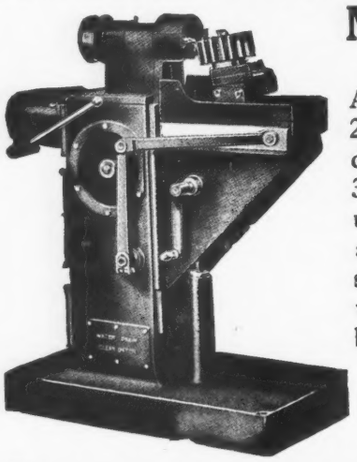
**NEWARK GEAR CUTTING MACHINE CO.**

**NEWARK** HENRY E. EBERHARDT, President **NEW JERSEY**

# SPEED AND ACCURACY

in gear tooth rounding can only be attained if the machine which does the work is constructed in accordance with the best mechanical principles. The Walker Gear Tooth Rounding Machine fulfills every requirement.

*Our Improved* **Gear Tooth Rounding Machine**



Any pitch from 2½ to 20—any diameter up to 30"—any face up to 12". These are the dimensions of the work handled by this machine

*Get the facts. Write*

**Charles H. Walker Machinery Co.**
DETROIT MICH., U. S. A.

AD "ZONES of QUIET" AD

# GEARS

They reflect their goodness by their unusual smoothness and silence in operation. We are equipped to produce

**Spur, Helical, Bevel, Mitre, Spiral and Worm Gears, and Worm Wheels in all Metals, also in Bakelite**

Our modern equipped shops are operated continuously by workmen of long experience.

If you use gears, send us your blue prints or sample gears for estimates.

**ALBAUGH-DOVER CO.**
2100 Marshall Blvd. Chicago

**Flexible Metal Hose *and* Accessories**

**The Most Complete Catalogue and Reference Book Ever Published on the Subject**

PRESENTING technical information for the solution of many puzzling engineering problems; this book is submitted for careful study and reference, and to enable the reader to explain his problem clearly so that we may solve it for him.

*Will be sent only in reply to requests on business letterhead*

**BREEZE MANUFACTURING CO.**

Write for our Manufacturers Sales Agents proposition giving full particulars of territory covered and lines carried.

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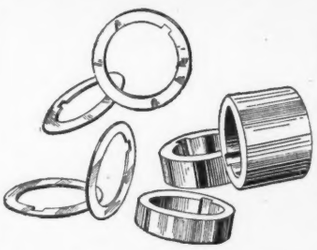
NEWARK BREEZE FLEXMET NEW JERSEY



# DON'T

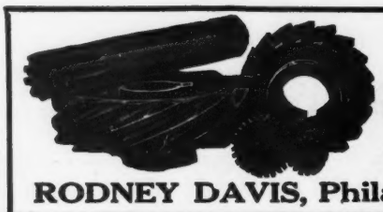
let your man cut paper or tin washers for your milling machines. You can get steel washers .003, .004, .005 and .006 thick at $3.00 per 100 giving you a variation by the thousandth. We also make collars from ⅛" to 3" long for the various arbors.

**The Unity Manufacturing Co.**
4223 Lorain Avenue CLEVELAND, O.

**Hindley Worm Gearing**

**Complete drives with housing ready for power**

**ALBRO-CLEM ELEVATOR COMPANY**
501 Erie Avenue, East PHILADELPHIA, PA.

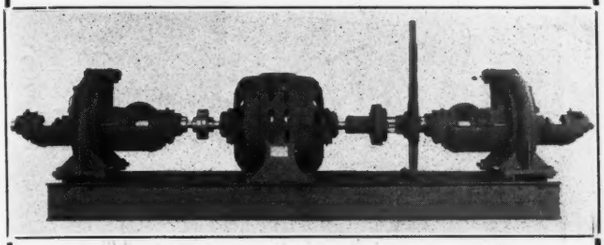


**Gears and Gear Cutting**

*We guarantee satisfaction*

**RODNEY DAVIS, Philadelphia, Pa.**

# The Hilliard Friction Clutch



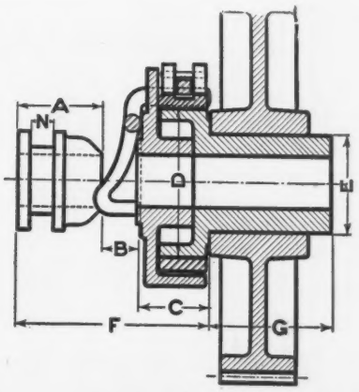
## Driving a Centrifugal Pump

Hilliard High Speed Friction Cut-Off Couplings are being used for direct connecting motors to Centrifugal Pumps—Blowers—Generators—Reduction Gears—Machine Tools and various types of special machinery.

It is peculiarly adapted for this class of work. Just what you are looking for!

State your requirements, we can help you.

**The Hilliard Clutch and Machinery Co.**
ELMIRA NEW YORK, U. S. A.



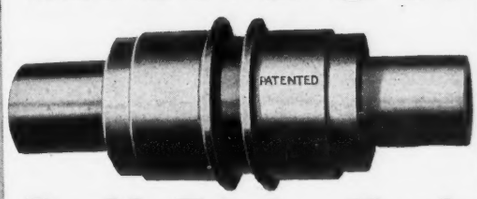

# TWO QUESTIONS:

Why does the farmer's boy slip off to New York?

Why do engineers change their ideas as to starting and stopping, and reconstruct their machines entirely, even as to design, after seeing Conway Clutch performance?

**CONWAY & COMPANY**
FAIRMOUNT CINCINNATI
MANUFACTURERS OF FRICTION CLUTCHES SINCE 1895

# HANSON




## Double Friction Clutch

Entirely cylindrical—perfectly balanced—compact, simple, powerful, fully interchangeable.

**HANSON CLUTCH & MACHINERY CO.**
TIFFIN OHIO, U. S. A.

*Single Clutches* *High Duty Countershafts*

# JULIUS BLUM & COMPANY

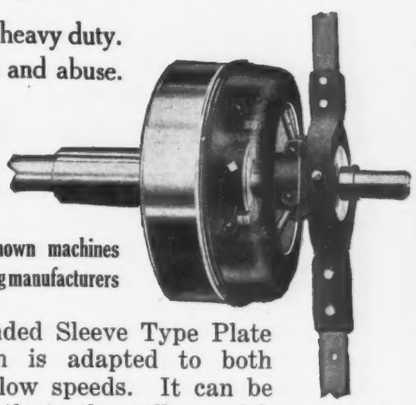
510 W. 24th St., New York, N. Y.
SEAMLESS STEEL TUBING—COLD DRAWN STEEL
STRIP STEEL—WROUGHT IRON MOULDINGS
HOT ROLLED SHAPES—BOILER TUBES

"FULFLO"

TROUBLE-PROOF
**PUMPS**
FOR ALL MACHINE TOOLS AND GRINDING MACHINES
THE FULFLO PUMP CO.
BLANCHESTER, OHIO

# Edgemont Clutches

For light and heavy duty.
For hard use and abuse.



**Standard Equipment**

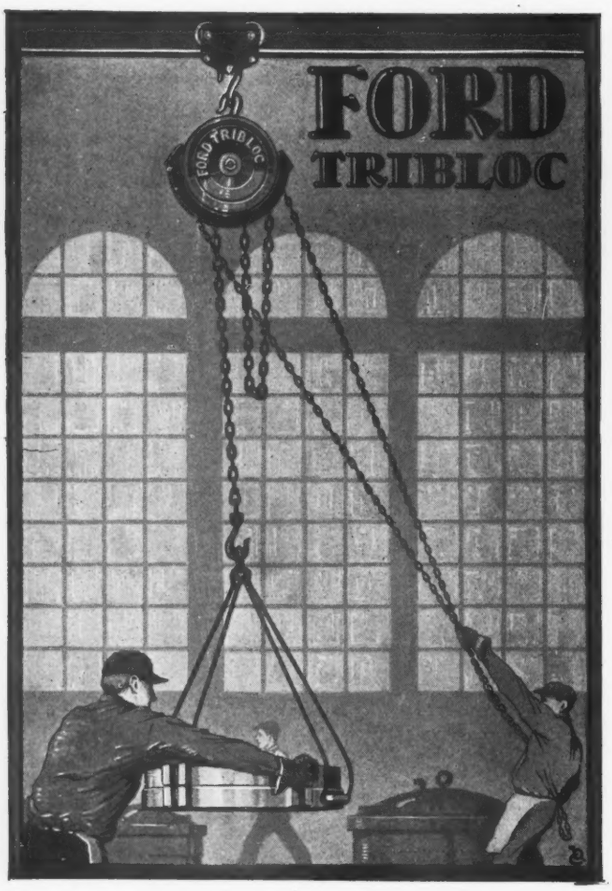
In many well-known machines endorsed by leading manufacturers

The Extended Sleeve Type Plate Mechanism is adapted to both high and low speeds. It can be fitted directly to the pulley and becomes at once an integral part of the machine.

## Edgemont Friction Clutches

are made in a wide variety of styles to meet varying loads and conditions and are guaranteed to transmit full rated power. Catalog for details.

**The Edgemont Machine Co.**
2700 National Avenue DAYTON, OHIO




# Give a Tribloc Severe Service

**—use it every day**
**—work it to capacity**
**—let anybody "run" it**
**—operate it indoors or out**

never falters, never fails, it's built for service and "delivers."

Gears, chains, hooks and all working parts are made of steel. The **Loop Hand Chain Guide** prevents "gagging" of the hand chain, injury to the block and overriding of the flange when working at excessive speed.

For a safe, durable, dependable hoist—it's a Tribloc with capacities of ½ to 40 tons. Guaranteed (in writing) for five years.

## Ford Chain Block & Mfg. Co.

**Second & Diamond Sts.** **Philadelphia, Pa.**

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
120 BROADWAY, NEW YORK, U.S.A.

PARIS TURIN ZURICH BARCELONA

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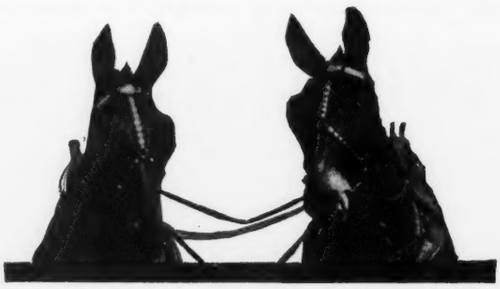


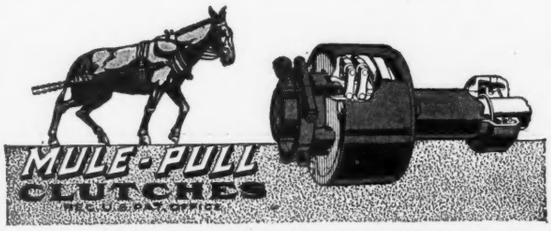
## Work minus Worry

A "Mule-Pull" Clutch is a fool-proof piece of machinery, built to give steady consistent service without the aid of a repairman.

A "Mule-Pull" has a special ring-oiling system that keeps oil a-plenty at every point that needs it, and other features which make it stand "head-and-shoulders above" in Friction Clutches.

Power transmitted for half—How? Our circular tells.

**Brown Engineering Company**
**133 No. Third Street** **Reading, Pa.**



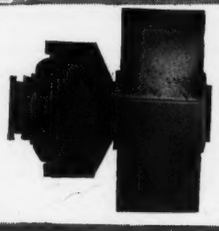

# CLEVELAND FRICTION CLUTCH

## 0

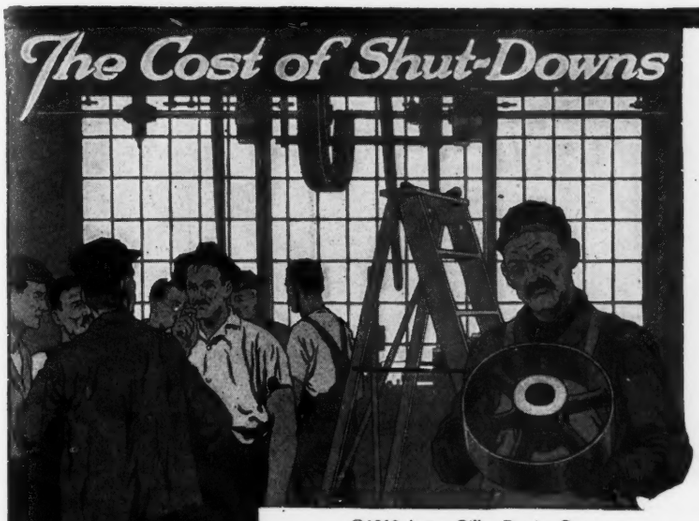
***to Worry About***

***"Install —That's All"***

It contains no jaws, joints, gears or toggles—no parts to work loose, burn out or damage. Completely interchangeable. Catalog D describes sizes up to 270 H.P. Send for it.



**RELIANCE GAUGE COLUMN CO.**
**6008 Carnegie Ave.**
**CLEVELAND OHIO**




Outwears the Best Bronze Metal

Arguto NON-METALLIC

Smoother than Grease

WHILE one man works to put in a new bushing, a dozen—perhaps more—are idle. Their machines are not turning. Or, if repairs can be made at night, you have to pay overtime rates.

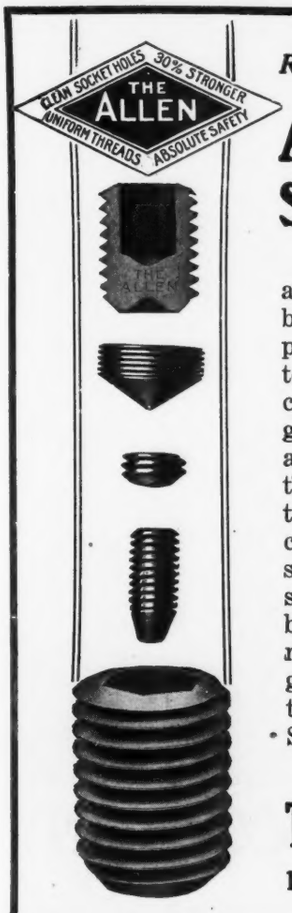
It is the labor and loss of production that make the big loss—the new bearings and the oil to lubricate them cost considerable in a year, but nothing to compare with the other loss.

©1918 Arguto Oilless Bearing Co.

ARGUTO OILLESS BEARINGS actually cost less than bronze or babbitt and yet that is the negligible saving. The real saving comes from their continuous operation from 8 to 15 years without oil (Argutos are self-lubricating) and without any attention whatsoever, but especially because this long life means years without a shutdown. That spells profit and low manufacturing costs. ***At your service for information.***

**ARGUTO OILLESS BEARING CO.,** 145 W. BERKLEY STREET **Wayne Junction, Philadelphia**

***Arguto Oilless Bearings***




***Reduce Insurance Risks***

## Allen Safety Set Screws

are indorsed by the Liability Insurance Companies. Made from high test steel bars by a special process designed to give sufficient leverage and plenty of metal for the necessary strength at the point. Accurate die cut threads made to standard gauges. Allen screws are hardened by the most scientific methods and thoroughly guaranteed. Send for the catalogue of the *real* Safety Set Screw.

**The Allen Mfg. Co.**

**135 Sheldon St., HARTFORD, CONN.**

## NORTHERN HOISTS

**AC or DC ELECTRIC**

***All Types***
***½ to 10 Tons***

*Get Our Electric Hoist Catalog*

**NORTHERN ENGINEERING WORKS,** DETROIT, MICH.

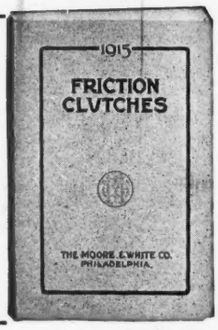
*MAKERS OF NORTHERN CRANES*

# Figure Your Friction Clutch Installations With This Book

*Sent free upon request.*
*Write today for a copy.*

Contains Complete Information Regarding Friction Clutches for All Kinds of Work.

Weights, Bores, Dimensions, Speeds, Horsepowers, etc.



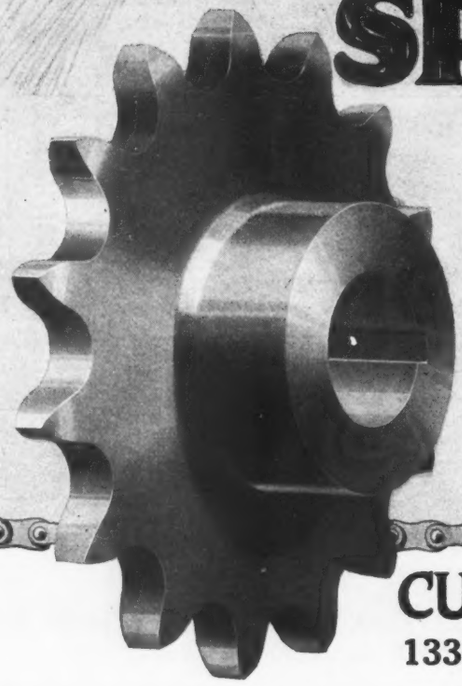

We make Standard Clutches for low speeds and moderate horsepower. High Speed Clutches for high speed and great horsepower. If you have any use at all for Friction Clutches, send for Catalog "M." "M & W" Friction Clutches eliminate transmission troubles.

**Made Only by THE MOORE & WHITE CO.**

**2707-2737 NORTH 15th STREET, PHILADELPHIA, PENNSYLVANIA, U. S. A.**

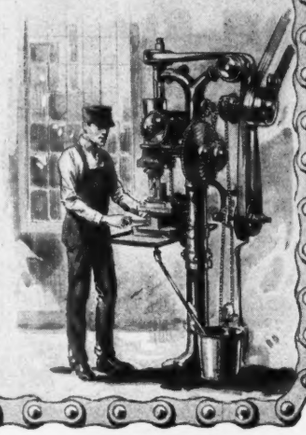
**Sold by leading dealers in Mine, Mill and Factory Supplies**

# CULLMAN SPROCKETS

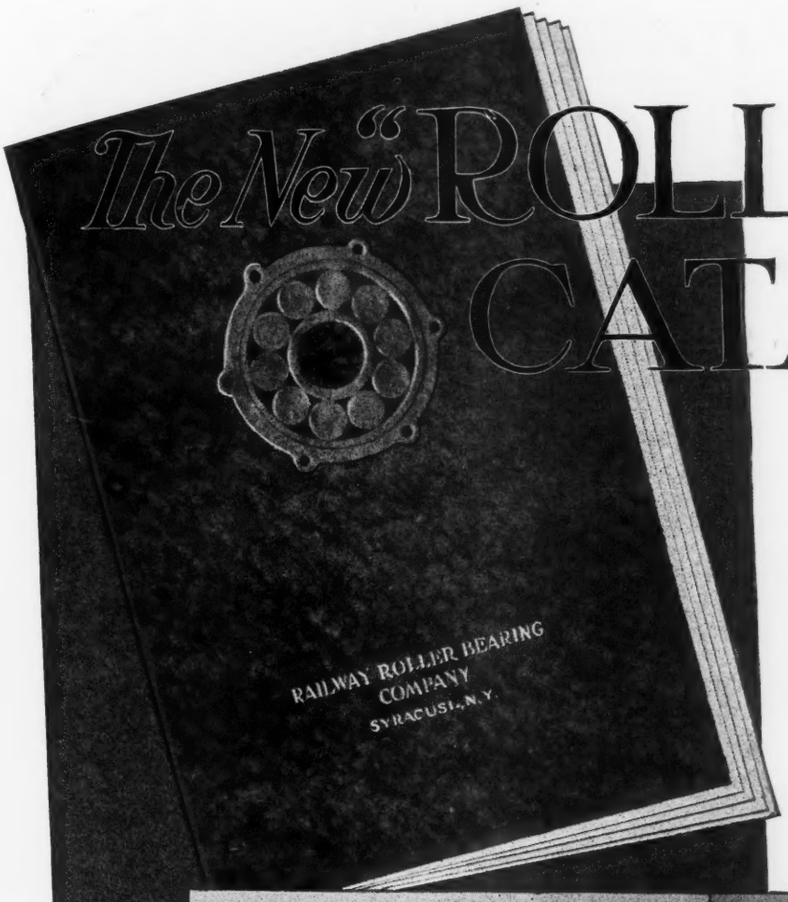


**Stock and to Order.**
**Diamond, Whitney, Baldwin, Duckworth, and Coventry Chains.**
**Block, Roller and High Speed Silent Types on Hand.**

***Catalog?***



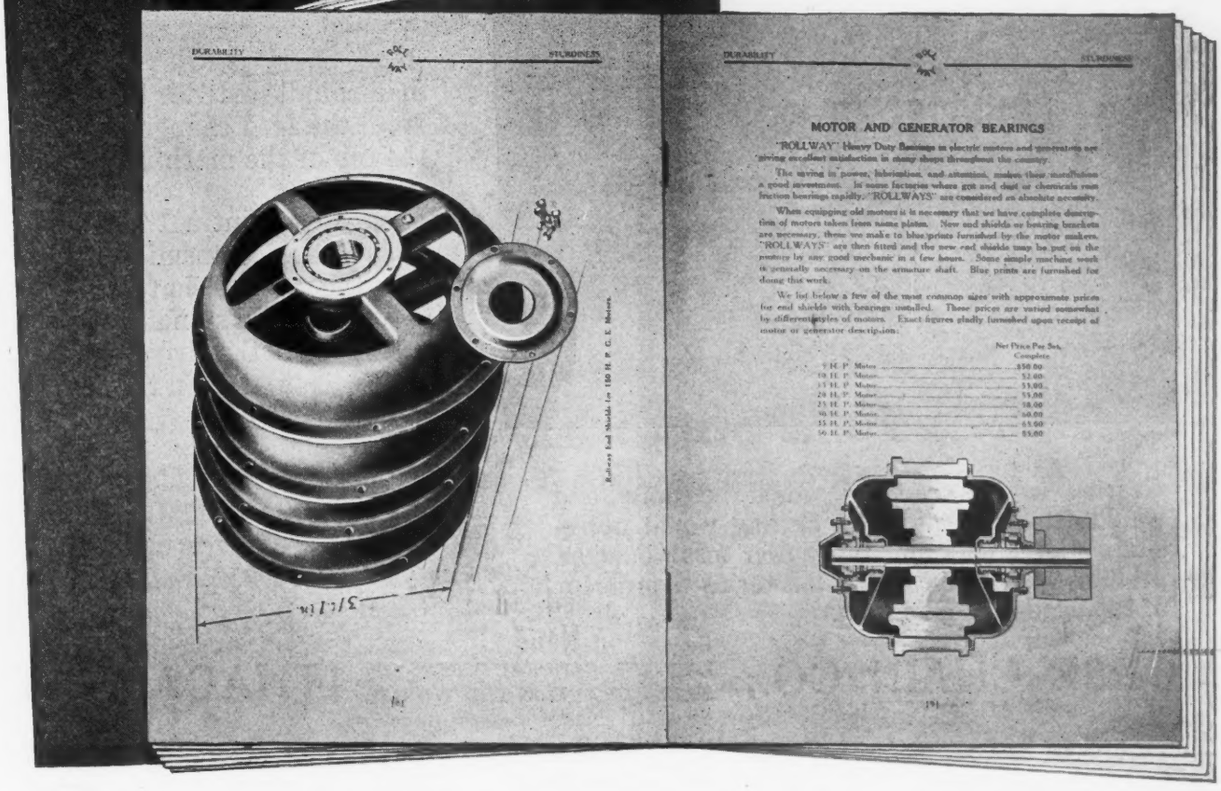
**CULLMAN WHEEL COMPANY**
**1339 Altgeld Street Chicago**




# The New "ROLLWAY" CATALOG

## The Solution of Your Bearing Troubles Lies Within the Pages of This Book

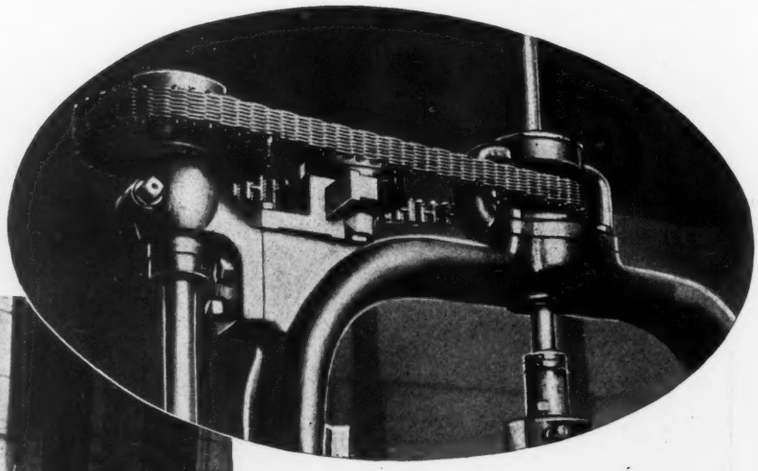
Contains a general discussion of the all important subject of "bearings" in their relation to the efficient and economical transmission of power. Tells all about "Rollway" Bearings — simple, durable, designed for any load, any speed, any thrust. *Write for your copy today.*

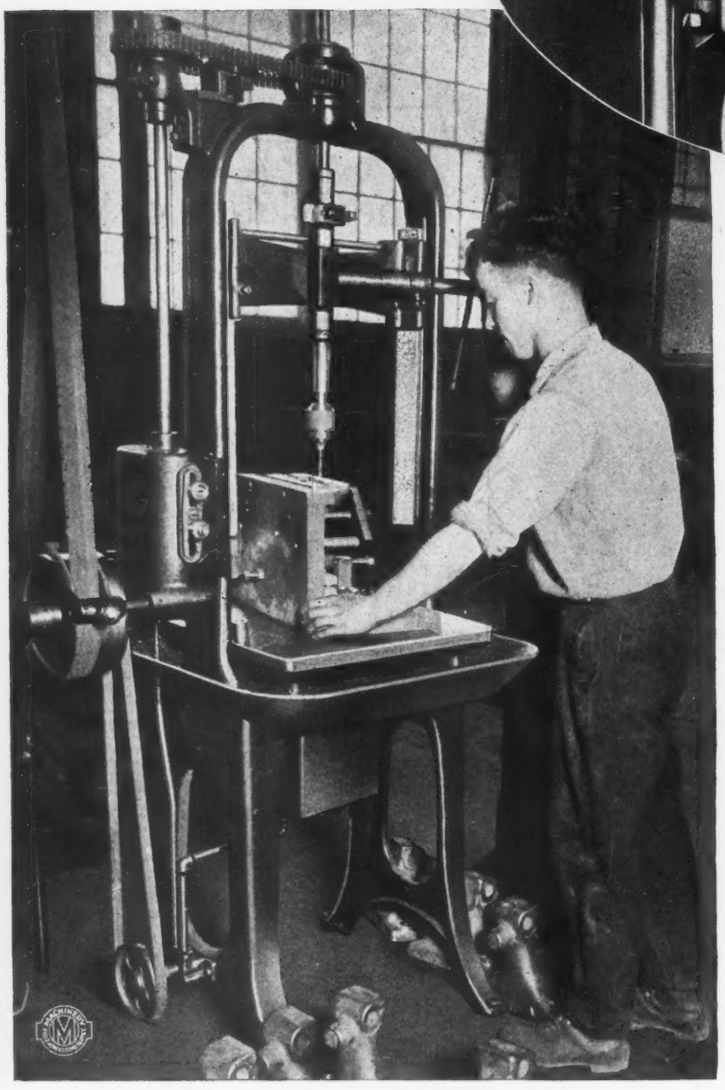



# RAILWAY ROLLER BEARING COMPANY

SYRACUSE NEW YORK

# The Drive for High Speed or Heavy Service





## There are Reasons Why this New Drilling Machine is Driven by Morse Silent Chain

This new drill is a product of the Edlund Machinery Co., of Cortland, N. Y., and is designed for heavy duty drilling at high speeds.

As may be seen, a vertical drive shaft parallel to the drill spindle extends upward from the feed change box to the top of the machine.

From this point a 1″ Morse Silent Chain transmits power to the vertical shaft which drives the drill spindle. The sprocket on the drive shaft has 37 teeth, that on the drill spindle 25.

With the drive pulley running at 500 R.P.M., four spindle speeds are obtained —380, 660, 950 and 1215 R.P.M.

**Gearing in this capacity would be noisy and would depreciate rapidly. Belting would necessitate a large idler and the power loss would be prohibitive. Chain is the answer to a problem of this kind—Morse Chain.**

**MORSE CHAIN CO.,** LARGEST MANUFACTURERS OF SILENT CHAINS IN THE WORLD **ITHACA, N. Y.**

*Morse Engineering Service* *Write for Booklets* *Assistance Without Obligation*

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**"Morse is the Guarantee Always Behind the Efficiency, Durability and Service**

# "Saves us 75%"

"That's what this OAKITE cutting compound does for us.

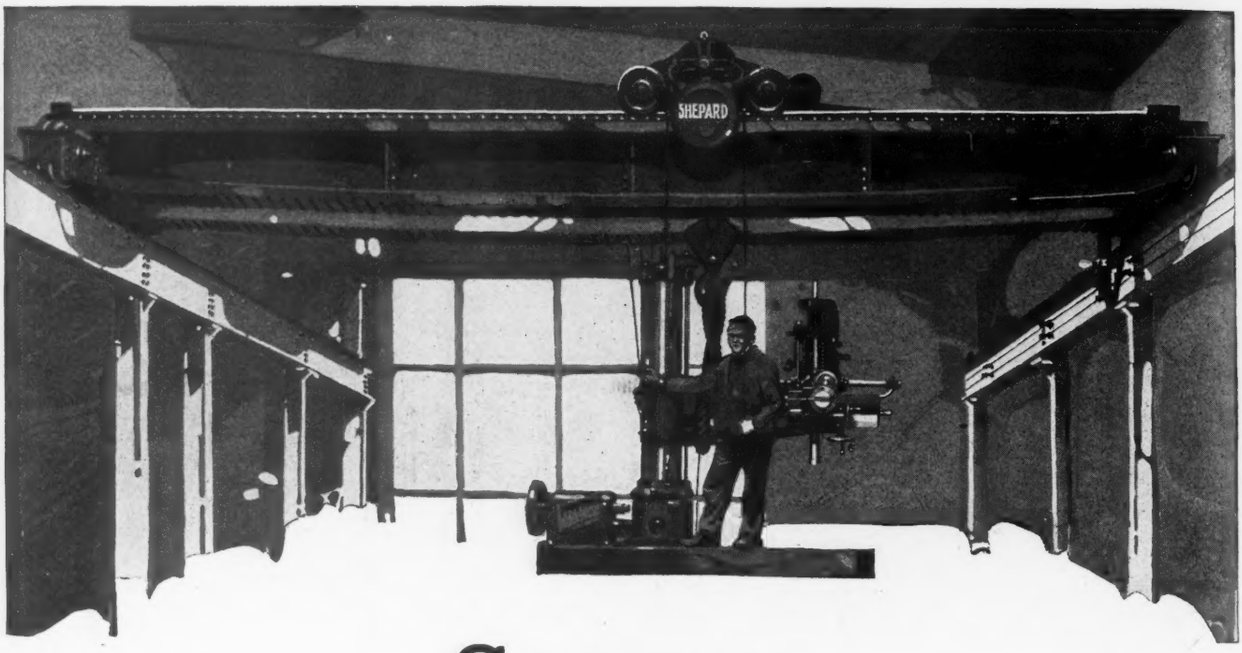
This Advertisement is one of a series based on actual occurrences.

**"We make it up with Oakite and it costs just one fourth of what our old cutting oil used to cost.**

**"With this Oakite cutting compound we get a finer cut, our tools keep cooler and do not have to be sharpened so often — and the work does not rust.**

"And say, the men like it fine! It keeps their clothes and hands cleaner and does not make sores on their arms like the old oil did."

**OAKITE** MANUFACTURED BY
OAKLEY CHEMICAL CO.
26 THAMES STREET · NEW YORK




# Secure

Accurately placing a heavy piece of machinery is not difficult with the simple, sure control in

## Shepard Electric Cranes and Hoists

The plant that is equipped with a "Shepard" is certain of properly handled loads, even by unskilled workmen.

Constant, trouble-free service with practically no maintenance expense is the result of the dirt-proof, damp-proof, fool-proof unit construction of Shepard Cranes and Hoists. The housed gearing, turning in an oil bath, receives the thorough lubrication necessary for steady, hard work and is also protected from possible interference in its proper operation. The unit construction of a "Shepard" is more than a distinctive design. It means economy.

**Tell our engineers what you want to move, and they will recommend the hoisting and transfer equipment that will do it most economically. Our Handbook will give you a brief but comprehensive idea of the possibilities in a specialized "Shepard" in your shop.**

**SHEPARD ELECTRIC CRANE & HOIST COMPANY**

**354 Schuyler Avenue, Montour Falls, N. Y.**

**New York, Philadelphia, Chicago, Pittsburgh, Boston, Baltimore, Cleveland, San Francisco, Montreal, Melbourne, London**

*Member of Electric Hoist Manufacturers' Association*

2032-S

REG. U.S. PAT. OFF.

SHEPARD
ELECTRIC CRANES & HOISTS

# Toledo Cranes

## LET US HELP SELECT YOUR EQUIPMENT

The selection of the correct crane installation to meet your specific requirements is of paramount importance. On this to a large extent depends the efficient operation of the whole plant.

We maintain a staff of experts who will go over the ground with you. They will advise, without obligation on your part, what crane or other equipment they consider best—how it should be installed. Consult them; it may save you money on your initial investment, and will make for greater economy in after operation.

We build Steel Bridges and Structures, Electric Cranes, Hoists, Coal and Ore Handling Machinery, Grab Bucket Machinery.

**The Toledo Bridge & Crane Co.**

**TOLEDO OHIO, U. S. A.**

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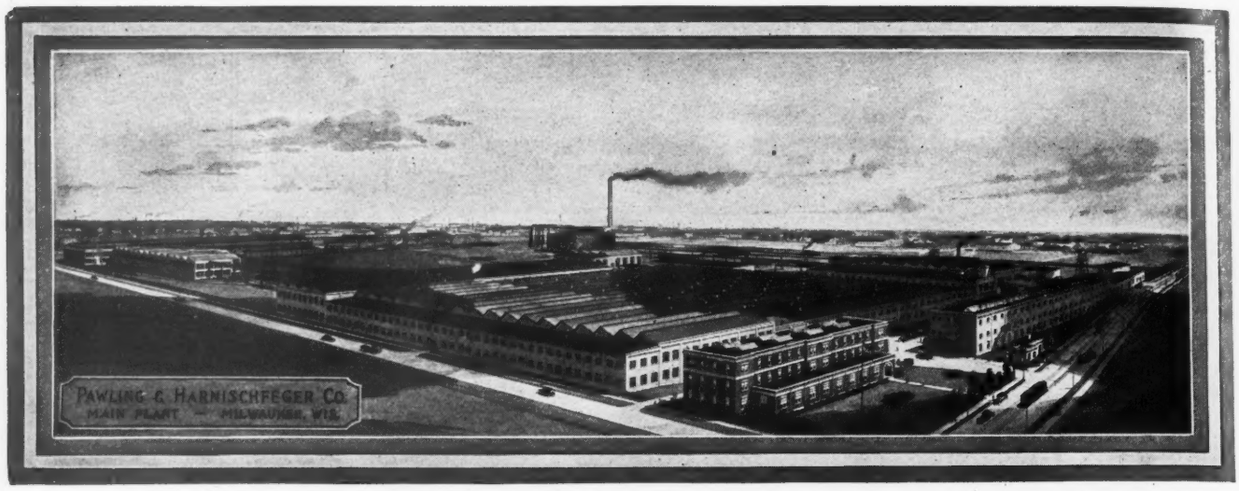


# How This Plant Meets the Emergency!

IN every wearing mechanism there is a time when some part requires replacement. When it is so fundamental to production as a crane or hoist, a temporary disablement assumes the proportion of a serious emergency. It is then that the crane or hoist user relies upon its builder for immediate aid. At no other time is the value of standardized equipment so forcibly brought home to him.

P & H Cranes and Hoists, though built to meet specific dimensions and requirements, are completely standardized in their component wearing parts: gears, gear cases, brackets, couplings, shafts, axles, bearings, truck wheels, sheaves, and breaking equipment. These parts are manufactured in quantities and placed "on the shelf," ready for the emergency. When an order for a renewal part is received it passes immediately to the Renewal Order Department whence it is routed through stock and shipping Departments with special dispatch. In all extremely urgent cases the shipments are immediately followed by "tracers" to avoid delays in transit. But a short time ago a prominent tractor manufacturer near Chicago "long distanced" us that a bridge truck wheel on his crane had broken, making further operation hazardous. The new wheel ordered lay at his door the following day. *That is how P & H Service meets the emergency.*

We are able to give such degree of service on cranes and hoists of earlier standards; the part-standardization system having been in practice since the early days of our organization. Quantity production of standard crane parts carries with it an advantage fully as important as the renewal feature, namely, speed in crane building. A P & H Crane, from girders to motors, is fabricated entirely in the P & H Plant; *we are manufacturers not assemblers.* During the war period a P & H Crane for an Eastern Ordnance Plant was built and shipped complete in two weeks time. Such accomplishment would have been impossible had we been dependent on outside sources for component crane parts. *That is how P & H met an emergency!*

Meeting the emergency by satisfactory performance is service — this is one of the pillars upon which the reputation of the P & H Crane is established.

**PAWLING & HARNISCHFEGER CO.**

MILWAUKEE, WISCONSIN

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1208 Stephen Gerard Building; Philadelphia.
926 Whitney Central Building, New Orleans, La.
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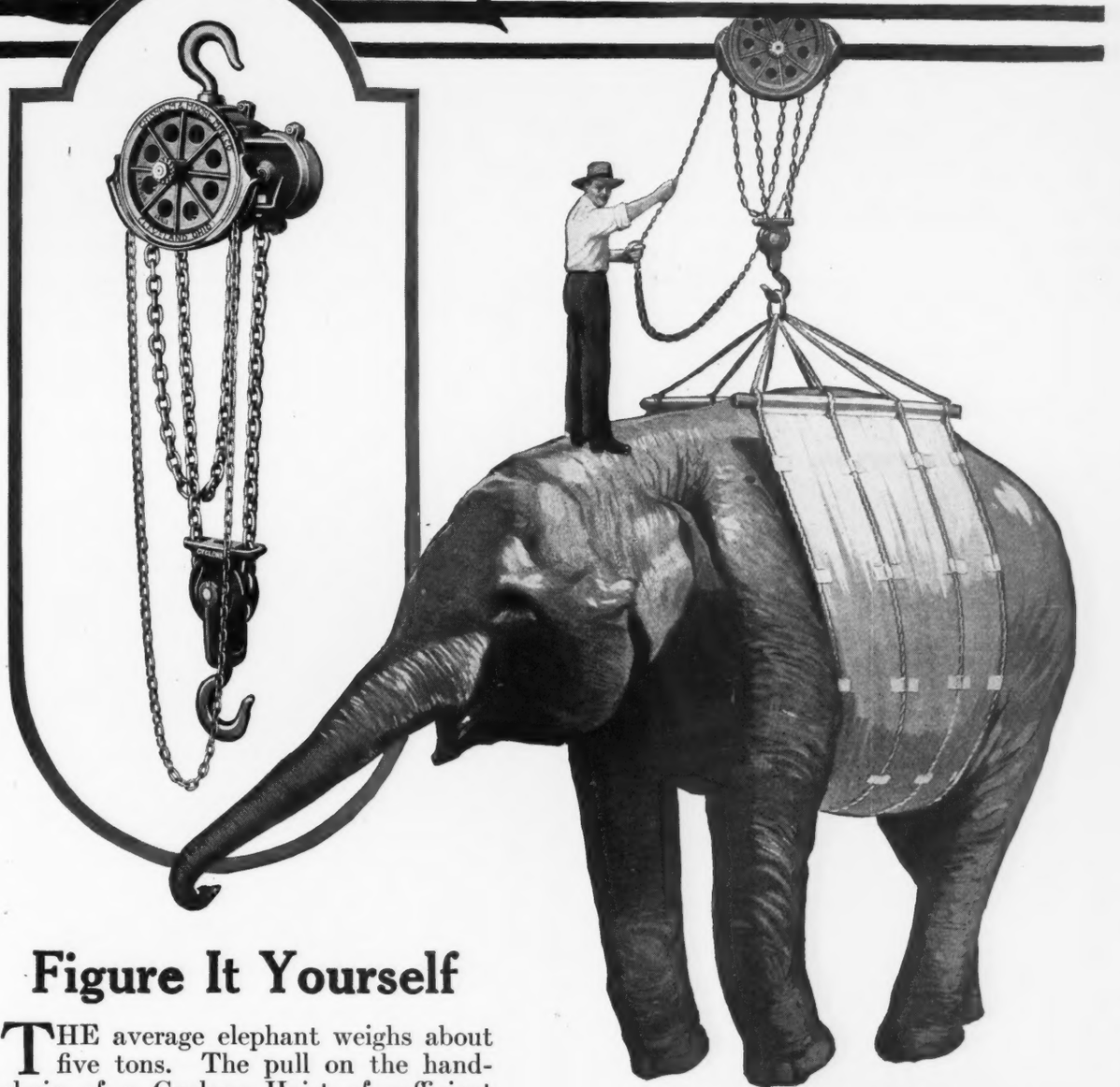
1104 Central Building. Los Angeles, Cal.

**P&H cranes-hoists-monorail systems**

# CYCLONE HOISTS



## Figure It Yourself

THE average elephant weighs about five tons. The pull on the hand-chain of a Cyclone Hoist of sufficient size to raise 6 tons is only 109 pounds. That pull is easy for an ordinary man.

While it is quite probable that you have never thought of hoisting an elephant, it is also possible that you have never thought of all the places in your plant where Cyclone Hoists could profitably be used.

To get the full details of the dividend-raising Cyclone Hoist write for 96-page catalog today.

**The Chisholm-Moore Mfg. Co.**
Cleveland, O.

Hoists · Cranes · Trolleys

Branch Offices:

| New York | Pittsburgh | Chicago |
|---|---|---|
| 30 Church St. | Henry W. Oliver Bldg. | 554 Peoples Gas Bldg. |

***It's Perfectly Possible***

This picture was drawn, not with the desire merely to present the bizarre or humorous, but to graphically drive home the possibilities of a Cyclone Hoist.

# THE SHAW ELECTRIC CRANE COMPANY

WORKS MUSKEGON, MICHIGAN

SALES OFFICES IN ALL PRINCIPAL CITIES

## MANNING, MAXWELL AND MOORE, INC.

PRINCIPAL OFFICE - 119 WEST 40TH. ST., NEW YORK.

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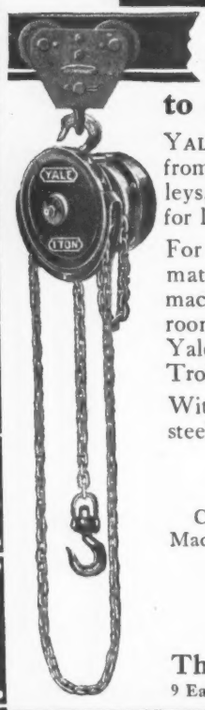


**From bins to machines to cars—use Yale Hoists**

YALE Spur-Geared Hoists, suspended from "Brownhoist" Steel-Plate Trolleys, on overhead tracks, are ideal for lifting and moving loads.

For delivering raw and semi-finished materials to machines, and from machines to assembling or shipping rooms, and then to cars for shipment, Yale Spur-Geared Chain Blocks on Trolleys, are economical equipment.

With both hoist and trolley of special steel construction *safety* is assured.

**'From-Hook-to-Hook-a-Line-of-Steel'**

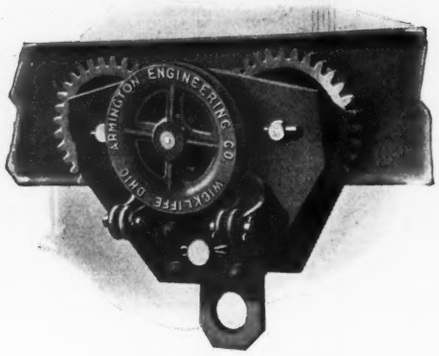
Catalog 18D tells all—or ask your Machinery Supply House.

***For a Factory Locking Equipment use a Yale Master Key System.***

*Write for Particulars*

**The Yale & Towne Mfg. Co.**
9 East 40th Street New York City

# ARMINGTON
## Monorail Equipment




*Type "B" Geared*

**A Full Line of "I" Beam Trolleys Always in Stock**

**Hand and Electric HOISTS AND CRANES**

**ARMINGTON ENGINEERING CO.**
EUCLID, OHIO

# CRESSON-MORRIS CO.

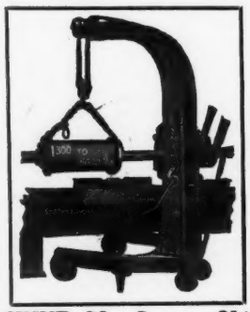
## Power Transmitting Machinery

We make a specialty of equipping plants completely with Power Transmitting Machinery, including Shafting, Rope Transmission, Machine-Cut and Molded Iron and Steel Gears for heavy service.
Almost sixty years' experience and competent engineering advice are at your disposal.

**CRESSON-MORRIS COMPANY**
*Engineers—Founders—Machinists*
PHILADELPHIA PENNA., U. S. A.

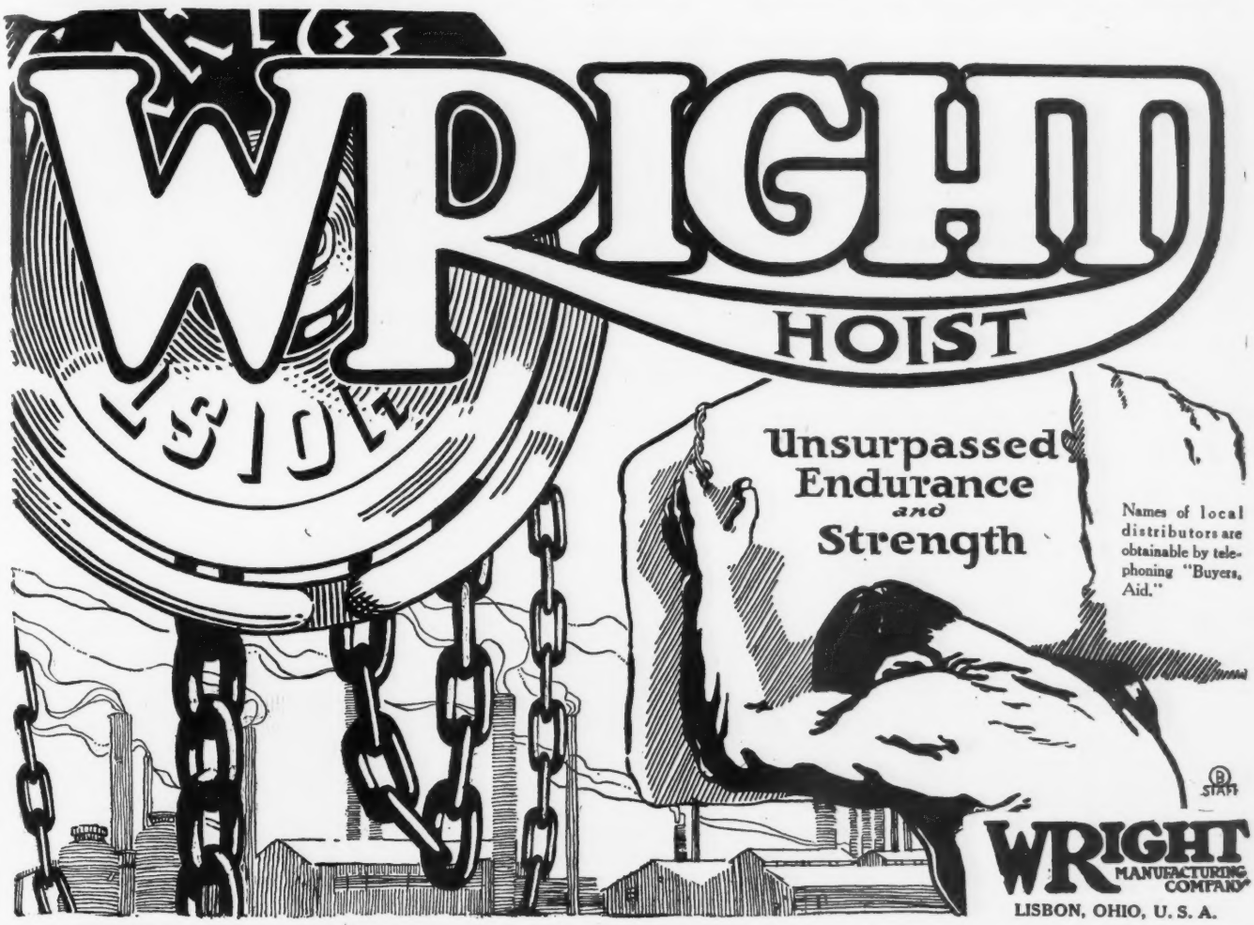
# Canton Portable Floor Crane

A convenient and efficient means of transporting heavy loads from place to place in the shop. Its low base enables the Canton Crane to be pushed under the machines and simplifies the setting of large pieces of work.



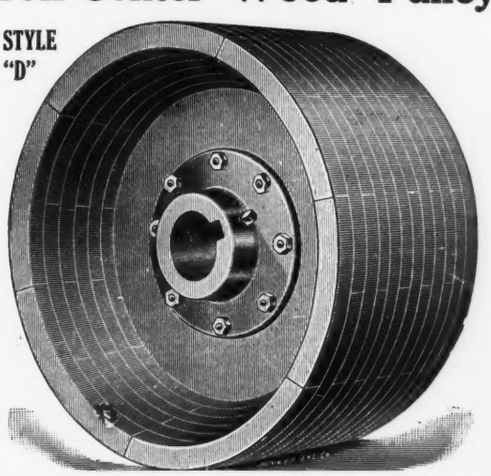
***Send for Catalogue E 10 for details of the "Handiest Tool in the Shop."***

**CANTON FOUNDRY & MACHINE CO., Canton, Ohio**




## The Gilbert Special Iron-Center Wood Pulley

STYLE "D"



Maple wood rim, iron center pulleys designed for extra heavy work. Style D will transmit from 40 to 50 per cent more power than an iron rim pulley and can be run at much higher speeds.

Gilbert Wood Pulleys are made in all sizes, and can be used wherever a leather belt is used.

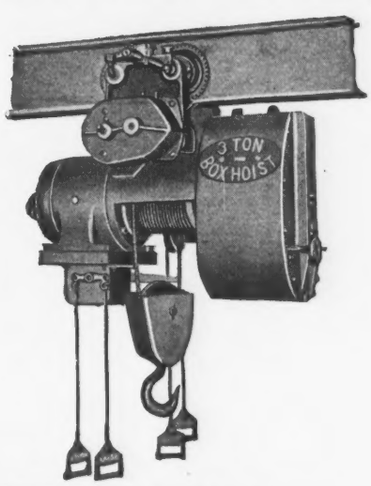
Catalogue?

**Saginaw Manufacturing Co.**

SAGINAW, W. S., MICHIGAN

Sales Agencies in all the Principal Cities in the World. New York Branch, 88 Warren Street. Chicago Branch, 105-109 So. Jefferson Street. Cable Address, Engrave. A. B. C. and Lieber's Codes.

## Electric Hoists




**The SIMPLICITY of DESIGN—**
**The ENCLOSED CONSTRUCTION—**
**The RESERVE CAPACITY and the EXPERIENCE with which they are built should suggest**
**BOX ELECTRIC HOISTS for your installation**

Bulletin 1200-M on Request

ESTABLISHED 1878

**BOX CRANES**

ALFRED BOX & COMPANY, INC. PHILA. PA.

# Elevating, Conveying and Power-Transmitting Machinery

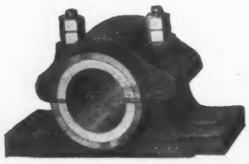
Screw conveyors, apron, belt, cable, drag and vibratory conveyors—steel conveyor troughs.

Bucket elevators, with or without steel casings. Elevators for boxes, barrels and packages.

Gears machine molded, cast teeth. Gears, cut teeth. Bearings, chain, pulleys, flywheels, friction clutches, shafting, elevator buckets.

## H. W. CALDWELL & SON CO.

CHICAGO, 17TH STREET & WESTERN AVENUE



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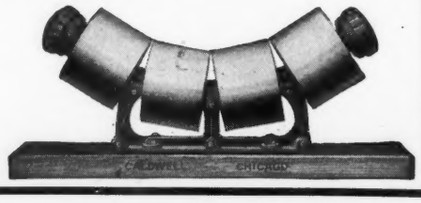
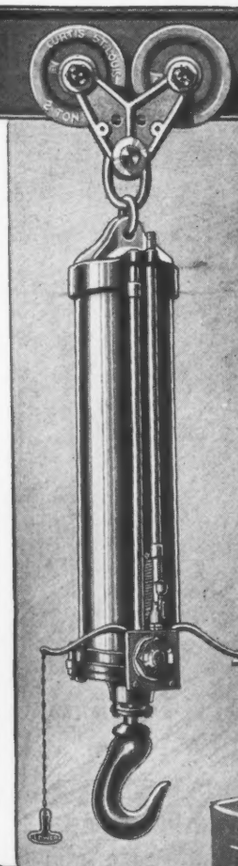


# CURTIS *Air Hoists*



## Economical—Safe—Dependable

The Curtis Air Hoist has been so perfected in its speed regulation, design and mechanical construction that it is the simplest, safest, most economical hoist for light and medium capacities. It effects a decided saving in man power.

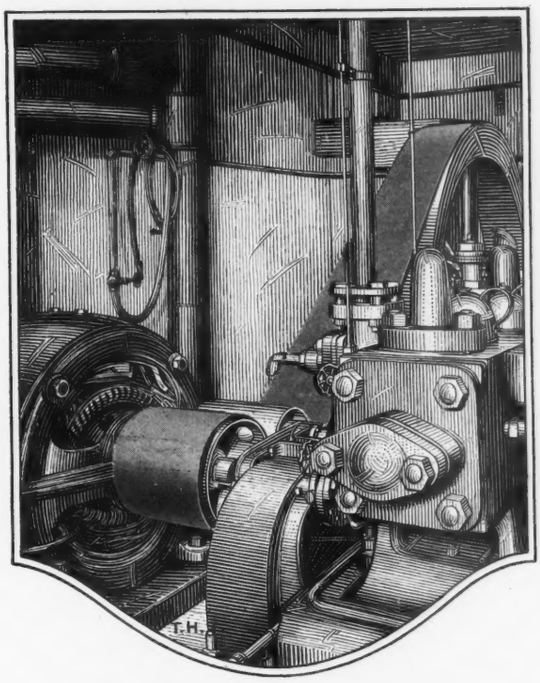
### A Hoist to Meet Your Needs

CURTIS AIR HOISTS have been successfully adapted to meet a wide variety of needs in hundreds of the leading industrial plants throughout America.

Our Engineering Department is at your service, ready to study any special conditions you have to meet and recommend suitable equipment. Illustrated descriptive literature and full information on request.

**Curtis Pneumatic Machinery Co.**
1568 Kienlen Ave., St. Louis, Mo.
*Branch Office—530-G Hudson Terminal, N.Y.C.*

*Do you know that the centrifugal force in belts at high speed reduces their driving power until at about 9600 F.P.M. a belt is incapable of transmitting power? All such factors are taken into account by our Engineering Department when they design standardized belt drives. Consult them about your problem.*



*This is a 12-inch Spartan Double Belt, operating a 50 horse-power Gas Compressor. Its cost to date is ½c per horsepower per week. When this belt had been in use 18 months, the engineer wrote us that it had given double the length of service of belts previously used. This has now been in use over four years and is still going strong.*

# TOP NOTCH

This is another case where top-notch efficiency and economy have been obtained by simply installing the right belt for the work to be done.

For many years Spartan Belting has been dominating the hard drives that destroy other belts. That experience ranks it as top notch in leather, in tannage and in workmanship. It is unusually pliable, wonderfully elastic, it is the greatest of pulley grippers and without an equal for high speed, overload drives or where unfavorable conditions exist.

Spartan well exemplifies the three principles back of Graton & Knight Standardized Series Leather Belts: First, they are made of the right material—leather. Second, they are tanned in our own tannery specifically for belting use, thus assuring the right kind of leather. Third, they are graded into a Standardized Series—a belt for each class of power transmission requirements—standardized in manufacture and standardized for the work to be done.

Certain articles can be tested in a short time—not so belting. It takes years to test out the correctness of principles applied in power transmission. The result of 60 years' test of experience is that Graton & Knight Standardized Series Belting, the highest in grade, is also the most widely sold. That is a significant combination: highest quality—largest sale.

Many of the best belted plants ask us to specify the belting for every drive. Try the plan yourself. Then when buying, call for "Graton & Knight —— Brand or equal." This won't commit you to buying our belts. It will put your buying on the one basic consideration—the work to be done.

*Write for book on Standardization as applied to Belting*

## THE GRATON & KNIGHT MFG. COMPANY, Worcester, Mass., U.S.A.

*Oak Leather Tanners, Makers of Leather Belting and Leather Products*

Atlanta, Boston, Kansas City, Chicago, Cleveland, Minneapolis, Detroit, Fall River, New Orleans, New York, Philadelphia, Montreal, Can., Pittsburg, Portland, Ore., Seattle, St. Louis, London, Eng.

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# Graton & Knight

## Standardized Series

# Leather Belting

*Tanned by us for belting use*

Special
Alloy Steel for
GENUINE BALDWIN
ROLLER CHAIN
The enormous quantity of stock carried at all times insures Baldwin Chain output against interruption for want of material. It is just such provision for eachstep, from the ordering of the stock to the shipping of the finished product, that guarantees Baldwin dependability to the users of Genuine Baldwin Roller Chain and Baldwin Sprockets.
Write Dept. S. for full information
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GENUINE
BALDWIN
CHAINS
Over 4,000 Tons in Stock

# LADEW "TURTLE"

## Waterproof Oilproof Timeproof

We get what we pay for. Strictly speaking, there is no such thing as a "bargain" — particularly where belting is the commodity bought.

The best belt—and the most economical belt—is the one which, irrespective of price, delivers the most power over the longest period with the least attention-cost.

It is a fact of experience that good leather belting, rightly applied and rightly cared for, will deliver more power and last longer than any other belting.

It is also a fact of experience that, among good leather beltings, there is none better than "*Turtle*," with its service record of 59 years.

EDW. R. LADEW CO., INC.
GLEN COVE, NEW YORK, U.S.A.

*Since 1835*

**Branches and Distributors in all Principal Cities of the world carry Complete Stocks. See your Phone Book for local address.**

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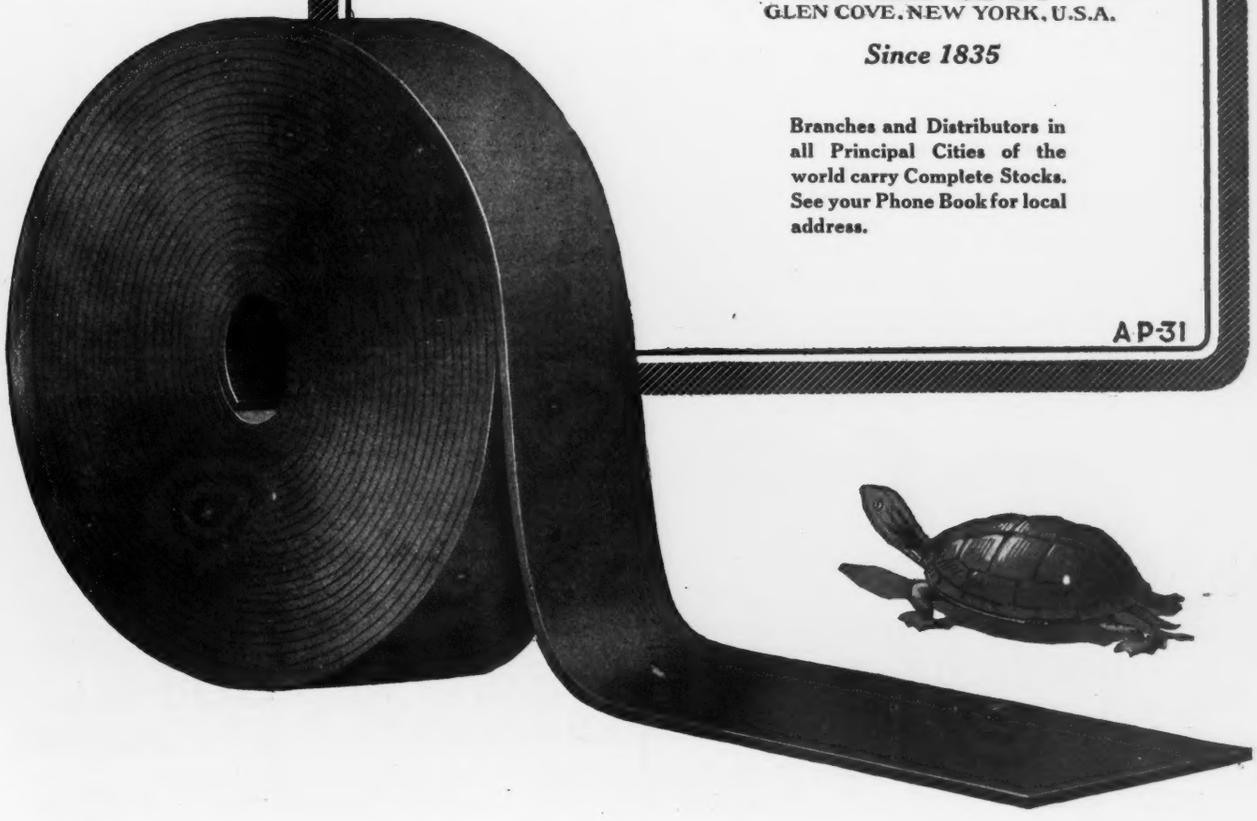
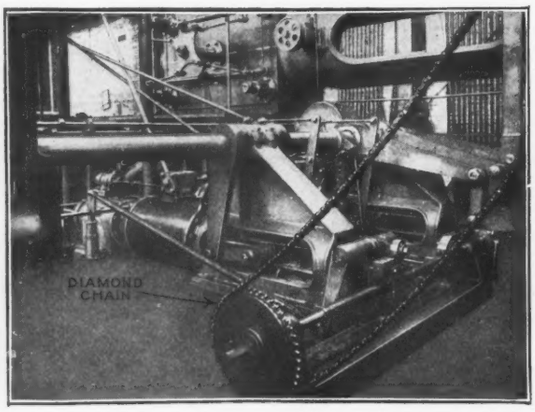





# Chain Drive Engineers

Through 30 years' experience designing and building ROLLER CHAIN DRIVES, we have well earned the reputation of being LEADERS in the Roller Chain field.

We can tell you promptly and correctly whether or not a "DIAMOND CHAIN DRIVE" will meet your requirements. It it will, you can have the most satisfactory kind of a drive at low cost.

BUT we will not sell you a chain until we are satisfied that it will do the work required.

Take us into your confidence as to your needs and let us give you the benefit of our experience.

Our complete catalog will be mailed gladly. Write us today.

**DIAMOND CHAIN AND MANUFACTURING COMPANY**

INDIANAPOLIS U. S. A.

PINTITE RIGID COUPLINGS

## For Line Shafting

# No Weak Spots in a Pintite-Coupled Shaft

Conclusive tests show that a **Pintite** Coupling has a load carrying capacity more than twice the rating of the shaft that carries it. And it **cannot** slip or work loose.

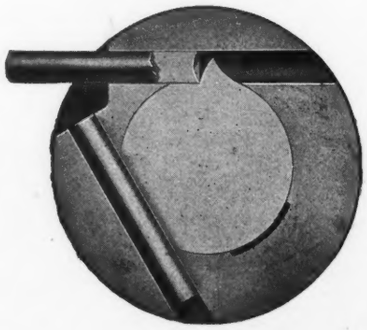
In other words, you can depend upon a **Pintite** Coupling to carry any load the shaft can stand.

Which means that a line shafting of the right size put up with **Pintite** Couplings, is trouble-proof—has all the power-transmitting capacity of a continuous steel shaft.

There are no weak spots in a **Pintite**-coupled shaft—it has an ample factor of safety throughout.

***All ordinary sizes of Pintite are ready for prompt delivery. Ask for Bulletin 102.***

**Keyed and Wedged**



**Immovable**

SMITH AND SERRELL

144 Cedar St. NEW YORK

*Francke Flexible Couplings for Direct-Connected Machinery*

# Silent Chain Drive Increased His Piece Rate Earnings 18%

THIS man is employed in one of America's leading manufacturing plants. He performs turret lathe operations on duplicate parts on a piece work basis.

Until recently his machine was belt driven. Now it is driven by Link-Belt Silent Chain. Since the change was made, his piece work earnings have increased 18%.

This increase was made on the same machine, same class of work, same operations, same hours, same everything as when belt drive was used.

His increased output is the direct result of the positive, non-slipping, smooth running effect of Link-Belt Silent Chain on the work in hand.

You, too, can increase the output of your plant, better your product and enable your piece work operators to enjoy greater returns by adopting Link-Belt Silent Chain Drive.

It is "flexible as a belt, positive as a gear, more efficient than either". Send for our Machine Tool Drive Book No. 312. Shows many applications and gives details.

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## SILENT CHAIN DRIVES

**We Also Make**

- ☐ Elevators and Conveyors
- ☐ Link-Belt and Sprockets
- ☐ Silent Chain Drives
- ☐ Truck and Tractor Chains
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- ☐ Locomotive Cranes
- ☐ Wagon Loaders
- ☐ Coal and Ashes Systems

Write for Catalogs
Place X in Square

# "Pioneer" STEEL HANGERS

"FUNNY thing about millwrighting these days; the less I charge for it the more profit I make.

"It's because of the 'Pioneer' Steel Hangers. Before folks got to ordering them, I had to pay at least two helpers, even for a small job, as it takes two men to hold one of those heavy cast-iron hangers and another to bolt it into place. This 'Pioneer' Hanger is made of rolled, open hearth steel, pressed into stiff, rigid shapes and is so light I can hold it and bolt it myself, so of course, I can charge less and still be a lot to the good.

"They tell me that these 'Pioneer' Hangers don't cost any more than the cast-iron ones while I know for a fact that they never give way, no matter what goes wrong, which is sure a good thing, for I've seen a sight of damage done—yes and lives lost too—when a heavy iron hanger let fly. So it's small wonder they are called for more and more."

*"I have a booklet that was sent me by the chap that makes these hangers—'Transmission Data' it's called and it surely is interesting reading. If you're still using iron hangers in your shop, I'd advise you to send for a copy."*

## STANDARD PRESSED STEEL CO.

PHILADELPHIA U. S. A.

## Cut Operating Waste

In meeting the keen, "after-war" competition, manufacturers will find their profits depending largely on the elimination of all needless operating waste. Air resistance and belt slip are responsible for power losses and coal waste that run into large figures.

The only honest tests to show how pulley faces hold belts are those made under working conditions by trained observers with reputations to lose.

Tests under working conditions have shown that the American Steel Split Pulley will transmit more power with less waste than any other pulley on the market.

They are correctly designed for maximum strength and light weight. They are recommended for rim speeds up to 6,000 feet per minute and guaranteed as to material and workmanship.

National distribution through supply houses from parent stocks in the larger cities.

*Write for 137 page book "Getting Maximum Pulley Efficiency" which tells how to eliminate pulley waste.*

**The American Pulley Company**
**Philadelphia, Pa.**

**AMERICAN STEEL SPLIT PULLEYS**

# HART STAGGERED ROLLER BEARINGS

## *Four Points of Superiority*

1. Staggered rollers permit a substantial reduction of the bearing angle, that is, the included angle between radial lines drawn from the axis of the bearing through the centers of adjacent rollers. Strain on the bearing is thus obviated.
2. Efficient lubrication is assured.
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4. The end of any roller which is lightly loaded is free to rotate independently of the heavily loaded end; that is, a differential movement occurs between individual sections of a given roller with the result that objectionable features resulting from eccentric loading of the bearing are overcome.

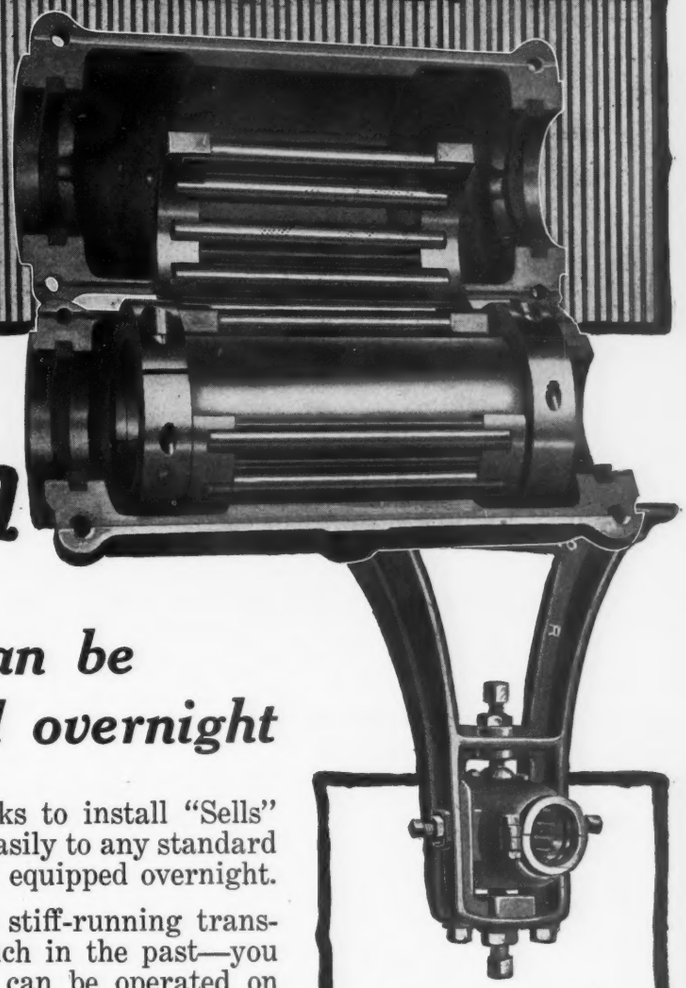
Made by the Owners of the Hart Patents

Let us send you all details on the ideal heavy duty bearing.

## THE HART ROLLER BEARING COMPANY

ORANGE NEW JERSEY, U.S.A.

# They help to speed up production



## *Your whole plant can be transformed overnight*

You don't have to close down the works to install "Sells" Roller Bearings. They can be fitted so easily to any standard hanger that your whole plant can be so equipped overnight.

And the next morning—instead of the stiff-running transmission lines that have cost you so much in the past—you have a smoothly running system that can be operated on approximately ten per cent less power.

"Sells" Roller Bearings are easy to install because they are split throughout. They require less power to operate because their friction load is from one-fourth to one-half that of babbitt bearings.

They run smoothly because there is no roller against roller friction; there is no end-thrusting; rollers do not get out of alignment.

And there are other features—many of them—all of which we explained in detail in descriptive matter which will be sent to you upon request. *Write today.*

John D. Sells
Manager.

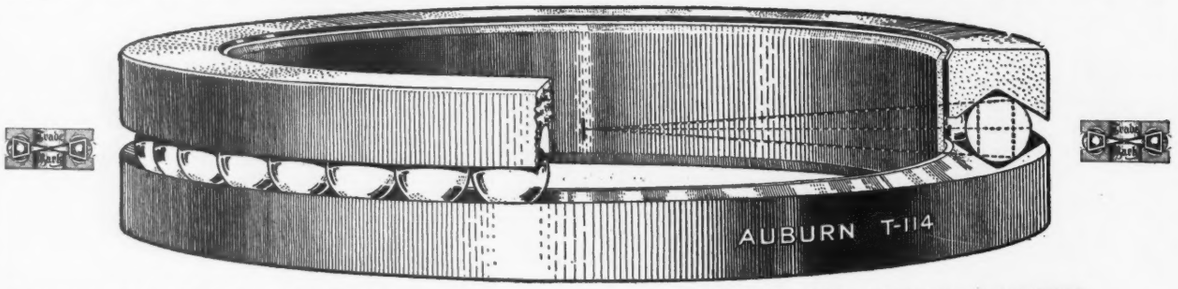
**ROYERSFORD FOUNDRY AND MACHINE CO.,**
**54 NO. 5th STREET, PHILADELPHIA**

***Other Royersford Economies***

"Sells" Roller Bearings for mine cars and wagons
Shaft Hangers, Collars and Couplings
Rollerine, the Ball and Roller Bearing Lubricant
Combination Oil and Grease Gun
Babbitted Ring Oiling Bearings
Punches and Dies
Punching and Shearing Machines
Sensitive Drill Presses, Drill Presses and Foot Presses
Grinding and Polishing Machines
Tumbling Barrels, etc.

**Old Reliable "Sells" Roller Bearings**

# AUBURN BALL THRUST BEARINGS




**AUBURN BALL BEARING CO.**
33 ELIZABETH STREET ROCHESTER, N. Y.

REGULAR AND SPECIAL BEARINGS
State Your Problem and Ask for Bulletins
STEEL, BRASS AND BRONZE BALLS

## The Schatz "Universal" Annular Ball Bearing

**WE DO NOT HESITATE**

to say that the Schatz "Universal" will operate with less attention and less lubrication without deterioration on account of the balls coming in direct contact with the races through absence of lubricant.

**WE DO NOT BELIEVE**

that our bearing should be operated with less expensive oils or greases than other makes, but we can safely claim that improper lubrication is less likely to result in burnt bearings in the Schatz "Universal" design.

*Please Send for Our Catalog.*

THE
**Federal Bearings Co.,**
INCORPORATED
42 William St., Poughkeepsie, N. Y.

GREAT BRITAIN :
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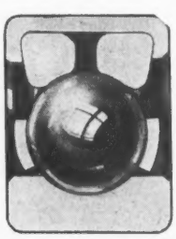
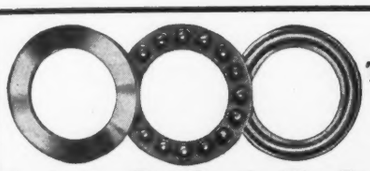


## GITS OIL CUPS

Give perfect satisfaction where others fail. State style and size in which you are interested, and we will send free samples and catalog.

GITS BROS. MFG. CO.
1940 S. KILBOURNE AVE., CHICAGO



**Rochester Thrust Bearings**
Are made in large sizes for heavy duty.
**Rochester Ball Bearing Co., Inc., Rochester, N.Y.**

"THE CHAIN OF DOUBLE LIFE"
Fits cut and Standard C. I. Sprockets—1 to 12 in. pitch.

**Union Steel Rivetless Chains**
High Carbon Links (STRENGTH). Large Glass-hard Reversible Bearings (DURABILITY), One-piece Rivetless Construction (PERMANENCY) insure TROUBLEPROOF, MONEY-SAVING SERVICE. Bushing Chains, Roller Chains, Sprockets, Buckets, Elevators, Conveyors, etc.
**The Union Chain & Manufacturing Company, Seville, Ohio**
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ADJUSTABLE HANGER

FOR HIGH SPEED — FOR HEAVY DUTY

ESTABLISHED 1854
ENGINEERS FOUNDERS MACHINISTS MILLWRIGHTS
THE A. & F. BROWN CO.
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POWER TRANSMISSION MACHINERY
GEARS
FOR MOTOR, MACHINE, MILL OR POWER PLANT
ROPE DRIVES A SPECIALTY

FRICTION CLUTCH PULLEY WORKS: ELIZABETH, N. J.

We lay out, make drawings, furnish the material and erect it. Special machinery built to drawings and specifications

# WHEN MACHINERY IS IDLE

WHAT does it cost when machinery is idle for even a short time?

As small a thing as a burned-out bushing may hold up production—and production means **money.**

Ordinary bushings need constant lubrication—neglect to oil them may result disastrously, for it is easy to overlook them. For this reason manufacturers are installing **Bound Brook** (Graphite and Bronze) and **Nigrum** (Impregnated Wood) **Oil-less Bushings** because they will maintain smooth running efficiency even if neglected.

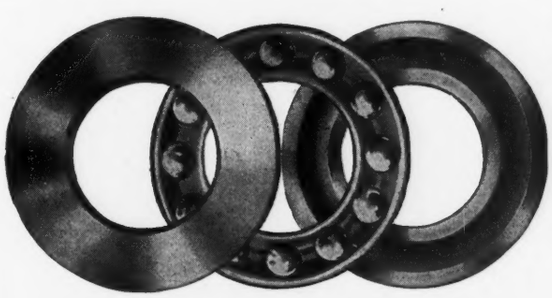
Our engineers will gladly talk over your requirements.

*All genuine Graphited Oil-less Bushings have always been made at Bound Brook, U. S. A.*

**Bound Brook Oil-less Bearing Co.**

*"Specialists in the manufacture of Oil-less Bushings for more than a third of a century"*

Bound Brook New Jersey
Detroit Office: 1723 Ford Building



## THE BEARINGS COMPANY OF AMERICA

*Manufacturers of*

**"Star" Ball Retainers**
for Thrust, Magneto, and Cup and Cone Types of Bearings.

**Complete Ball Thrust Bearings**
(Made to your Requirements).

**"Sterling" Universal Joints**
for Trucks and Passenger Cars.

**Drop Forgings**

**THE BEARINGS COMPANY OF AMERICA**
LANCASTER PENNA.

Western Sales Office: 1012 FORD BLDG., DETROIT, MICH.

# "NORMA" PRECISION BALL BEARINGS

(PATENTED)

In any machine, maximum serviceability can be had only when each link in the chain from power to performance has a capacity for its functions ample for every emergency. A consistent factor of safety must obtain throughout. And it is not unusual to find that a very inconspicuous part bears a tremendous burden of responsibility—may, by its failure, cripple the whole mechanism.

The bearings of any high-speed, high-duty, high-efficiency machine are vital to that machine's performance—can make or mar its record. Which explains why so many manufacturers of high-speed machinery safe-guard themselves and their customers by using "NORMA" Precision Bearings.

***Be SAFE. See That Your Machines Are "NORMA" Equipped.***

**THE NORMA COMPANY OF AMERICA**
1790 BROADWAY NEW YORK

***Ball, Roller, Thrust and Combination Bearings***

# Quality

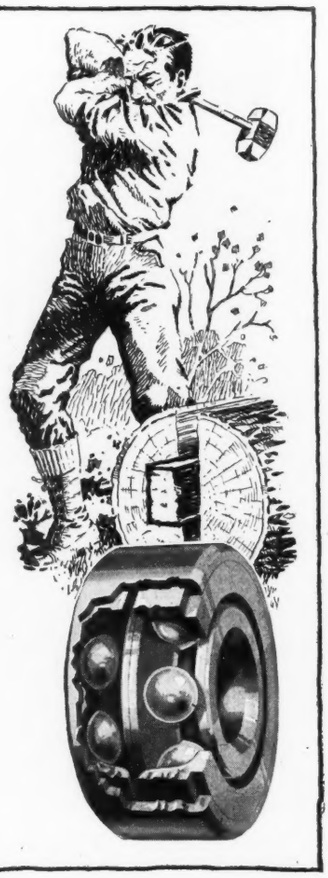
ANTI-FRICTION bearings of the ball type, such as the New Departure Double Row or Radax, are the only bearings that will successfully withstand thrust loads with absolutely no resultant wedging action.

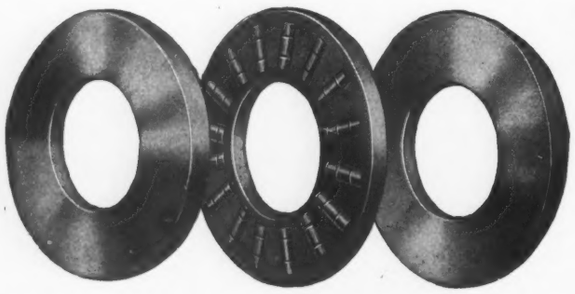
When other than ball bearings are employed, the thrust stresses intensify the internal pressures even as the blow of the woodsman's sledge intensifies the side pressure of wedge against log.

Nothing moves as easily as a ball. No other form of load-carrier moves with so little frictional resistance. That is why ball bearings reduce the evils of friction in your motor car or other machinery to a minimum.

THE NEW DEPARTURE MANUFACTURING COMPANY,
452 Bristol, Conn.

**New Departure Ball Bearings**



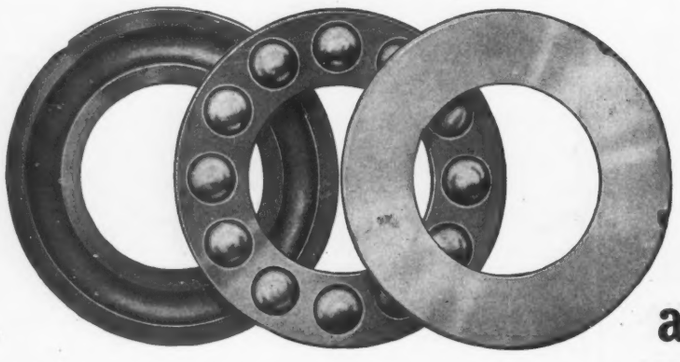


# It's a Foregone Conclusion

that it is the highest form of economy to use ball and roller bearings wherever they are practicable. It is quite safe to say that no other investment in the engineering field could be more satisfactory. The power bill is lowered, cost of maintenance is reduced, and a degree of permanency given, unobtainable with ordinary bearings.

So far so good; but where are you going to get them? Ask our regular customers—they know. They know our bearings cannot be surpassed, that the grinding is done with far more than ordinary care, that the attention we give to heat-treating would by many be considered superfluous. They know that the accuracy of bearing surfaces and raceways must conform to marvelously close limits—that all our products stand the severest tests of time and service. We make Radial Roller Bearings, Journal Roller Bearings, Roller Thrust Bearings, Ball End Thrust Bearings (in both inch and millimeter sizes) and Cylindrical Rollers. Choose the best since

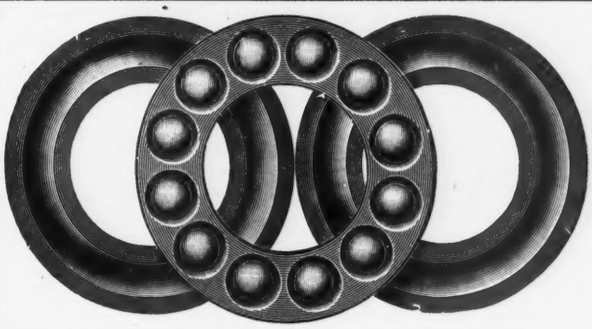
**THE BALL & ROLLER BEARING COMPANY**
DANBURY CONN., U.S.A.



**You Must Use Ball and Roller Bearings**

# Bantam Ball Thrust Bearings

Quality
Durability
Service



OUR CATALOG TELLS THE STORY

Twenty Years Experience

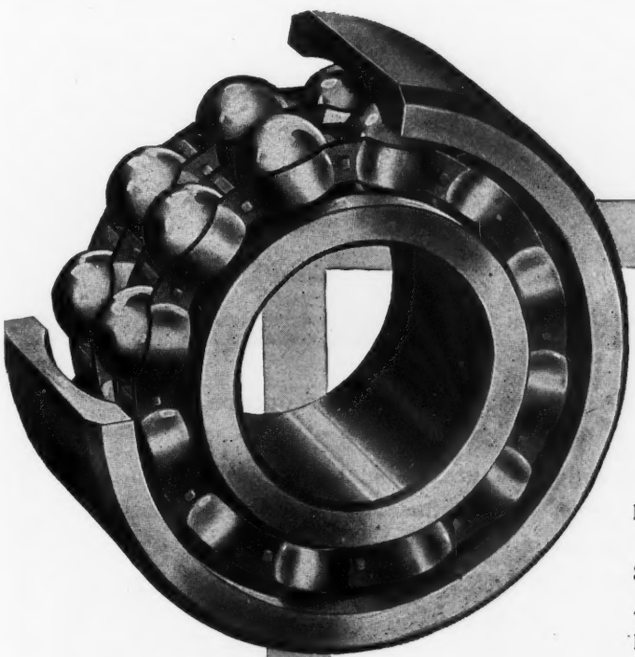
Twenty Years Success

## THE BANTAM BALL BEARING COMPANY

*Pacific Office:*
F. M. COBBLEDICK CO.
693 Mission Street
SAN FRANCISCO, CAL.

BANTAM, CONNECTICUT

*Detroit Office:*
905 Dime Bank Building
DETROIT, MICHIGAN
U. S. A.



SRB

## *The Standard Code*

MAXIMUM number of balls to more evenly distribute the load.

SILENT because of perfect fitting.

ANNULAR with deep raceways to withstand thrust.

BALL and raceway perfection that eliminates friction.

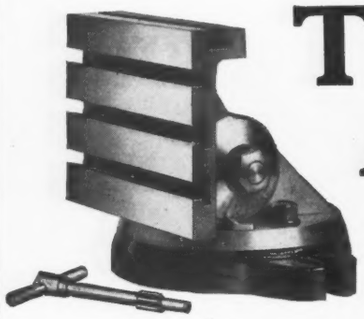
BEARINGS that will withstand a greater overload.

**STANDARD ROLLER BEARING CO., Philadelphia, U. S. A.**

SALES OFFICES:

Detroit, 936 Woodward Ave.
Chicago, 2206 S. Michigan Ave.
Indianapolis, 646 N. Meridian St.
New York, 1737 Broadway
San Francisco, 41 Spear St.
St. Louis, 3126 Locust St.
Boston, 84 Brookline Ave.
Cleveland, 2062 Euclid Ave.

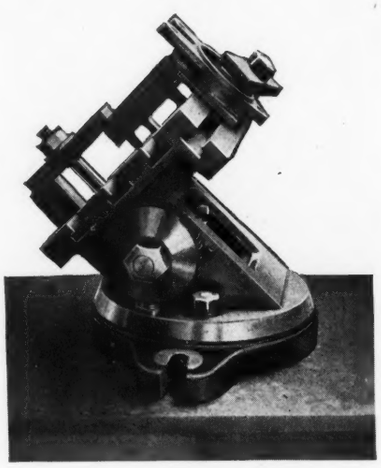
Makers of S R B Annular Ball Bearings, Taper Roller Bearings, Steel Balls and *Rudge-Whitworth* Wire Wheels.



Patented-Serial No 268 093

# THE NELSON Angle Fixture

***The Only Angle Fixture with a Second Face and T-Slot***



This second face and T-slot are by no means the only advantages of the Nelson Angle Fixture. It is lower and has less overhang than other fixtures of similar dimensions. A safety sub-clamping device for the table insures it against the slightest disturbance while being clamped for action and the swivel head is locked with *two* bolts which prevent lifting.

Also, a Sine Bar is regularly furnished to facilitate fine adjustment.

***Standard sizes — 6x9 and 10x12.***
***Larger and Toolmakers sizes available.***

**NELSON TOOL & MACHINE COMPANY**
**253 Norfolk Street** **NEWARK, NEW JERSEY**

UNIVERSAL OIL CO. LARD-EX CUTTING OIL NEW YORK

# LARD-EX CUTTING OIL

UNIVERSAL OIL CO. LARD-EX CUTTING OIL NEW YORK

LARD-EX to the PRODUCTION MANAGER means increased production, accurate parts, fine finish.

Its great refrigerating properties insure long tool life; eliminates frequent grindings and replacements of expensive tools. For fifteen years LARD-EX has been the standard brand specified by the critical shop man.

Makes a stable emulsion in plain water. NO GUM—NO FOAM—NO RUST.

Order your trial barrel TO-DAY.

Refinery: PETROLIA, PA.
Works: BELLEVILLE, N. J.

## UNIVERSAL OIL COMPANY

SPECIALISTS IN CUTTING LUBRICANTS
General Offices: 38 Fulton St., New York City

Warehouses: New York; Detroit, Mich.; Springfield, Mass.; Rochester, N.Y.; Boston, Mass.

# PENNZOIL LUBRO SOLUBLE CUTTING COMPOUND

## When users testify

*(Note the eleven distinct points.)*

"WE have found LUBRO to be very satisfactory on (1) screw machines, (2) turret lathes, (3) lo-swing lathes, (4) milling machines and (5) gear cutters. We have been cutting (6) ***all kinds of steel*** from .5 to .60 carbon and a large percentage of Chrome Vanadium with the best results.

"The effects in (7) bronze work are good, ***keeping the tools and work cool.*** We have (8) ***not noticed any bad effects on the ways of the machine which are generally experienced with other classes of compound.***

"By using LUBRO we have been able (9) ***to cut down our oil costs at least one-half.*** It is also (10) ***much more pleasant to work with*** than anything previously tried. The departments in which it is used are (11) ***much cleaner tha before,"*** so writes one user of

PENNZOIL LUBRO SOLUBLE CUTTING COMPOUND

Reading LUBRO advertisements makes no profits for your pockets. Your first barrel of LUBRO will. You won't be the first "doubting Thomas" to make the trial and find yourself doing faster work, wasting less time in sharpening tools and cleaning up, and saving money as well.

**THE OIL CITY OIL & GREASE CO.** **Oil City, Pa.**

*In the heart of the field which produces the world's finest lubricants*

**BRANCHES:**
210 Oliver Bldg., Pittsburgh, Pa. Canton, Ohio
910 Crozier Bldg., Philadelphia, Pa. Panama Lubricants Co., Los Angeles, Cal.

*A trial barrel convinces---order it.*

PENNZOIL LUBRO SOLUBLE CUTTING COMPOUND

ELECTROLYTIC OXYGEN-HYDROGEN GENERATORS

# Gas Cells

When you are purchasing gas cells for your plant, you have in mind certain main considerations. These are: purity of oxygen and hydrogen generated; number of cubic feet of gas produced in given floor space; efficiency and economy of process; longevity of apparatus; attendance required for apparatus and product; cost.

The **I. O. C.** System has a proud record of service in satisfactorily meeting these points.

Let us show you.

***"The cell with three times the capacity"***

*"Largest Manufacturers of Standard Electrolytic Oxygen and Hydrogen Apparatus"*

**INTERNATIONAL OXYGEN COMPANY**
**NEWARK N. J., U. S. A.**

**Verona, Pa. College Point, N.Y.**
**Chicago Pittsburgh Paris**
**I. O. C. Ltd., 38 Victoria Street Westminster, London, S. W.**

Registered
Empress Trade Mark

# EMPRESS
## GREASE AND OIL CUPS

INSURE YOUR MACHINES AGAINST LUBRICATION TROUBLES. SPECIFY THEM AS YOUR STANDARD EQUIPMENT AND INSURE THE GOOD WILL OF THE OWNER AND OPERATOR.

FRICTION KILLERS

***REMEMBER!***

THERE IS AN EMPRESS CUP DESIGNED ESPECIALLY FOR YOUR TYPE OF MACHINE.
HERE ARE A FEW. OTHERS EQUALLY GOOD ARE SHOWN IN OUR CATALOGUE.

***SEND FOR CATALOGUE "I" TODAY***

Fig. No. 116 Fig. No. 118 Fig. No. 53 Fig. No. 51 Fig. No. 52

**If oil lubrication is desired any one of these is to be recommended depending on the part to be lubricated.**

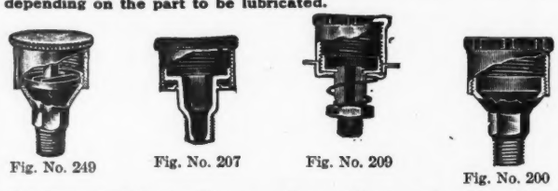


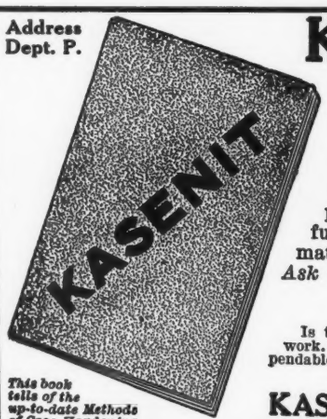
Fig. No. 249 Fig. No. 207 Fig. No. 209 Fig. No. 200

**For Grease Lubrication these are all very effective. Cups No. 249 and 209 are designed for places of excessive vibration. No. 207 is leather packed and absolutely cannot leak.**

## BOWEN PRODUCTS CORP.

**AUBURN DIV., AUBURN, N.Y. WINKLEY DIV., DETROIT, MICH.**
**ZERK DIV., CLEVELAND, O. MINN. DIV., MINNEAPOLIS, MINN.**
**Canadian Factory: CANADIAN WINKLEY CO., Ltd., WINDSOR, ONT**

**Address Dept. P.**




*This book tells of the up-to-date Methods of Case-Hardening. Copy sent free on request.*

# KASENIT

***Non-Poisonous***

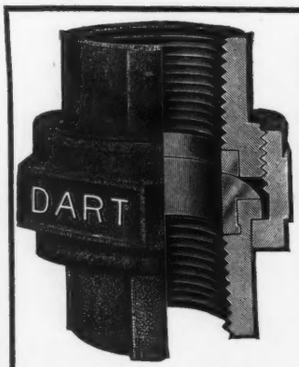
***Open-Fire Hardening Compound***

Rapid and uniform surface hardening without poisonous smoke and fumes. Replaces dangerous materials heretofore used. *Ask your dealer or write us.*

**"KASENIT No. 4"**

Is the Perfect Carbonizer for oven work. Absolutely uniform and dependable results at low cost.

**KASENIT COMPANY**
**11 Water Street New York**




# Dart Unions
## Ells, Tees, Flanges

Economical leak-proof joints that cannot rust or corrode.

Accurate, well fitting threads and bronze to bronze seats are the secrets of their satisfactory service.

Write us for prices and a sample union.

**E. M. Dart Mfg. Co., Providence, R.I.**

The Fairbanks Co., Sales Agents. Canadian Factory: Dart Union Co., Ltd., Toronto.

MODEL 22A MULTIPLE OILER—CAN BE HAD IN ANY NUMBER OF FEEDS

MODEL 12A OILER

ALL BRASS OILER

LOOSE PULLEY OILER

# There is a Michigan Oiler for every need

We can also meet a great many other brass goods requirements with our complete line. A few of our products are shown in this advertisement.

**MICHIGAN LUBRICATOR CO.**

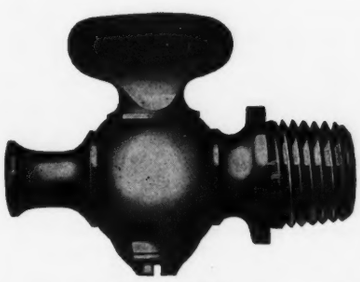
**Beaubien, Brady and Rowena Sts.**

**DETROIT MICHIGAN**

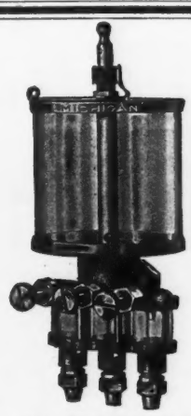
MA-53

175B GREASE CUP

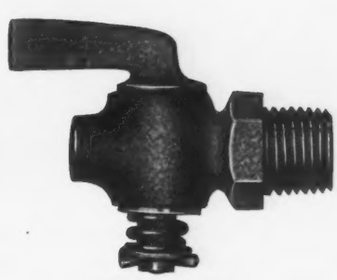
174B GREASE CUP



AIR COCKS

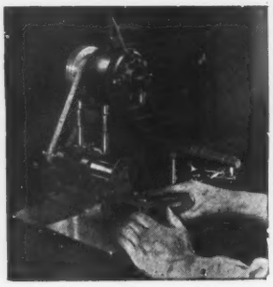
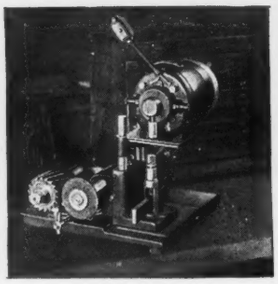
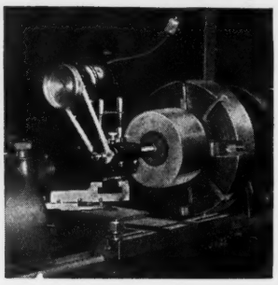



MODEL 53A THREE FEED OILER



DRAIN COCKS

# SAPHIL GRINDER

## Its Range is Exceptional

Take a walk around your shop; note the different jobs in course of completion. How many of those jobs could have been done better, cheaper and more accurately if the Saphil had played its part in them?

The Saphil Grinder will grind cutting tools of all descriptions, dies, jigs, fixtures. It is useful in a hundred ways to the instrument maker; and, attached to a lathe, will do external and internal cylinder grinding.

The spindle is mounted on SKF self-aligning ball bearings, with a double row of balls, and runs in oil—no end play, no vibration. The Saphil Grinder, equipped with either A.C. or D.C. motor is a complete tool, ready for use on delivery.

Easy to carry and handy to use. Weight 26 lbs.

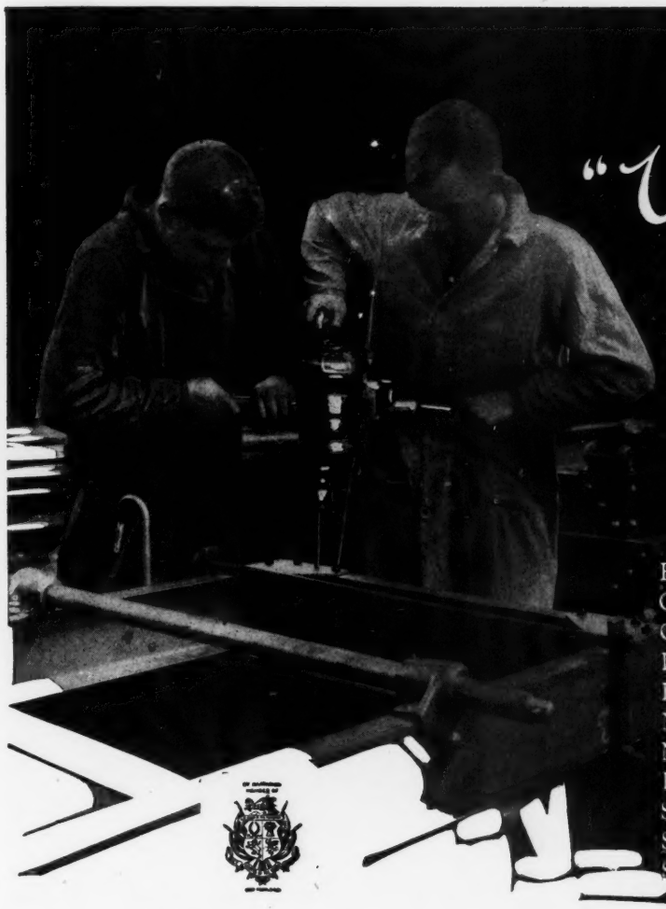
**SAPHIL MANUFACTURING CORPORATION**

141-143 West Austin Avenue
CHICAGO, ILLINOIS

*Domestic and Foreign Agencies*

***Ask for the Saphil Circular, and read the details.***

TRADE MARK
SAPHIL
CHICAGO



"Van Dorn"

PORTABLE ELECTRIC DRILLS

FOR QUALITY FOR DEPENDABILITY

The Van Dorn Electric Tool Co.
Cleveland, O.

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| Boston, Mass., | 170 Purchase St. |
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| Cincinnati, Ohio, | 1102 Second National Bank Bldg. |
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| Milwaukee, Wis., | 524 Wells Bldg. |
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| St. Louis, Mo., | 1122 Pine St. |
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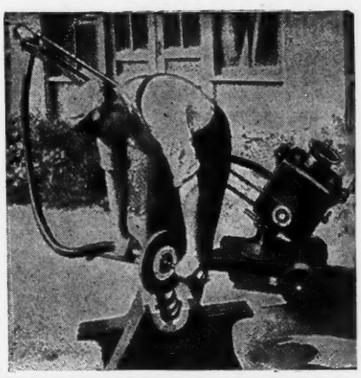
STOW PERFECTED GRINDER



ADJUSTABLE

Built in all sizes

Stow Tools are an investment and not an expense.

STOW MFG. COMPANY

Binghamton, N. Y.

*Oldest Portable Tool Manufacturers in America*

London Stock:
85 Queen Victoria Street

WINFIELD WELDING

Or Winfield Electric Riveting. Let us recommend the best for your product.

THE WINFIELD ELECTRIC WELDING MACHINE CO.

WARREN OHIO, U. S. A.

The Forbes & Myers Bench Motor Grinders

Convenience, simplicity and durability guarantee the economy of these compact machines. Designed for medium and heavy work. *Circular?*

FORBES & MYERS 178 Union Street Worcester, Mass.

PROGRESS:— "To go or move forward in space."—(*A Standard Dictionary*)

First, shank's mare, then old dobbin, next the steam engine, followed by the automobile—and now the airplane.

We're a progressive people and we do nothing by halves.

Twentieth Century Balancing Tool for Airplane Propellers

helps to safeguard our progress through the trackless air. Sensitive, practical and with an enviable record for war service, this device is in the class "indispensable."

Patent Applied For

*Maximum Swing, 11'. Approximate Weight, 285 lbs.*

MANUFACTURED BY

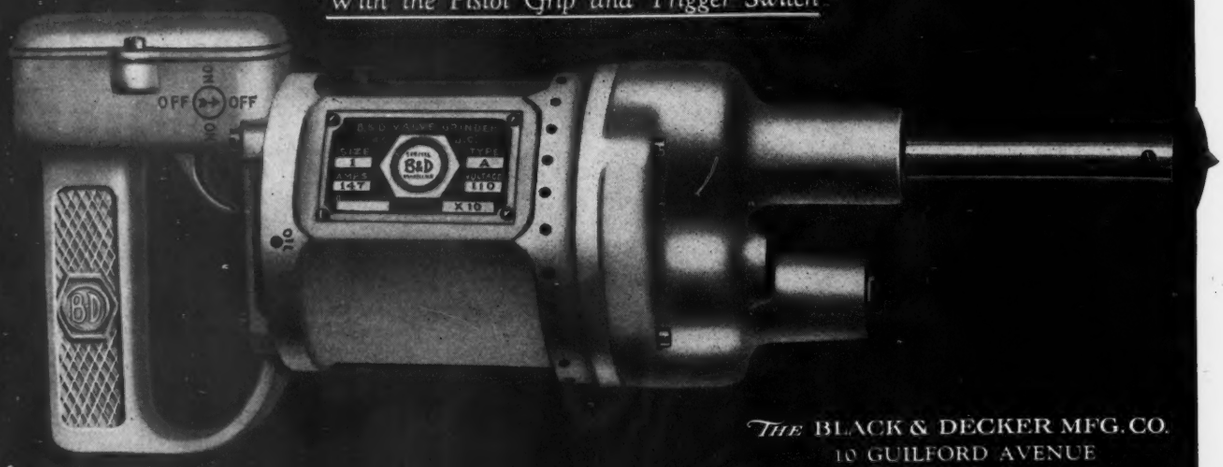
ROCKFORD TOOL CO.

Harrison Ave. and 11th Street
ROCKFORD, ILLINOIS

# BLACK & DECKER

## Electric Valve Grinder

*"With the Pistol Grip and Trigger Switch"*




THE BLACK & DECKER MFG. CO.
10 GUILFORD AVENUE
Baltimore, Md., U. S. A.

*Portable Electric Drills*
*Electric Valve Grinders*
*Electric Air Compressors*

BRANCHES
New York, N. Y. Columbus, Ohio.
Philadelphia, Pa., Atlanta, Ga.
San Francisco, Cal., Chicago, Ill.
Buffalo, N. Y., Boston, Mass.

Controls like an automatic pistol and is remarkable in its capacity for fast work and long service. Price $45.00

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Thor

## UNIVERSAL ELECTRIC DRILLS

(Licensed under Burke Universal Motor Patent)

## Drill by Electricity

You can drill holes in metal or wood in one-fifth the time required by hand.

No. 000
¼ inch
Drilling
Capacity

Equipped throughout with ball and roller bearings, smooth running

THOR SUPER-POWER motor prevents stalling on any work up to full rated capacity.

Jacobs Chucks furnished as regular equipment

## INDEPENDENT PNEUMATIC TOOL CO.

Chicago New York Pittsburgh Cleveland
Detroit San Francisco Birmingham Montreal

---

## Convenience cuts production costs

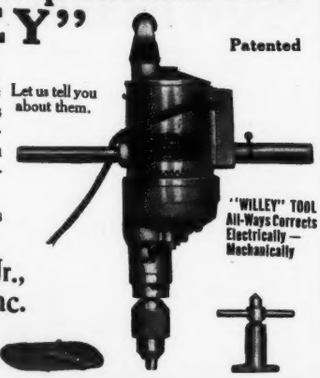
## "WILLEY"

Patented

Portable Electric Drills, Grinders, Buffers, etc., are well made, practical tools with enclosed type motors that can be used on either direct or alternating current.

Let us tell you about them.

Jacobs Chucks used as regular equipment.




JAMES CLARK, Jr., ELECTRIC CO., Inc.
522 W. Main St.
Louisville, Kentucky

---

## LATHE CENTER GRINDER

**Will grind lathe centers mechanically with scientific accuracy in fraction of time required with other methods.**

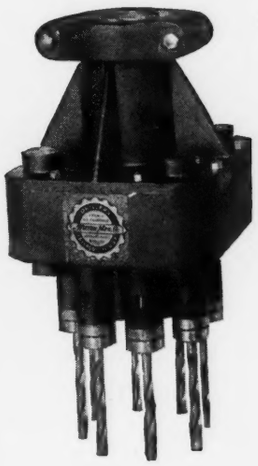
***Builders of "Ideal" Patented Portable Electric Tools, Grinders, Drills, Saws, Screw Drivers, Nut, Bolt and Lag Screw Setters***

**THE NEIL & SMITH ELECTRIC TOOL CO.**
**Cincinnati, Ohio, U. S. A.**

*Ask for Circular M*

# 2 MINUTES OR 20?

## This is the Vital Question

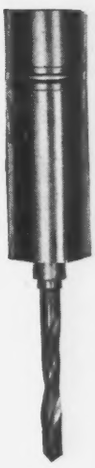


Do you drill ten holes in the time it takes for one? The Hoefer Auxiliary Head equips any driller so as to accomplish this big saving in time. It speeds up production in drilling tremendously. Not only do you save the drilling time, but also the time now lost in shifting the jigs and raising and lowering the spindle for the extra holes.

Hoefer Auxiliary Heads are made in any multiple, arranged in any manner, from 2 up. They are made by expert tool makers and unqualifiedly guaranteed to handle accurately the work for which they are designed.

Investigate now—every day you use a single drill where the multiple may be used you are paying for an auxiliary head through increased costs, but not securing its benefits.

Write for catalog. Send a blueprint of some of your work for estimate of time and cost.



**THE HOEFER MANUFACTURING CO.**

**FREEPORT ILL., U. S. A.**

CHICAGO ILLINOIS, 621 Washington Blvd., Phone Haymarket 2408. CLEVELAND, OHIO, 1113 Citizens Bldg., Phone, Main 795. PITTSBURGH, PA., 708 Empire Building, Phone, Court 1911 or 1912. DETROIT, MICHIGAN, 602 Kerr Building, Phone, Cherry 2884. NEW YORK CITY, 30 Church Street, Phone, Cortlandt 1615. MILWAUKEE, WISCONSIN, Badger-Packard Mchy. Co. TOLEDO, OHIO, National Supply Co.

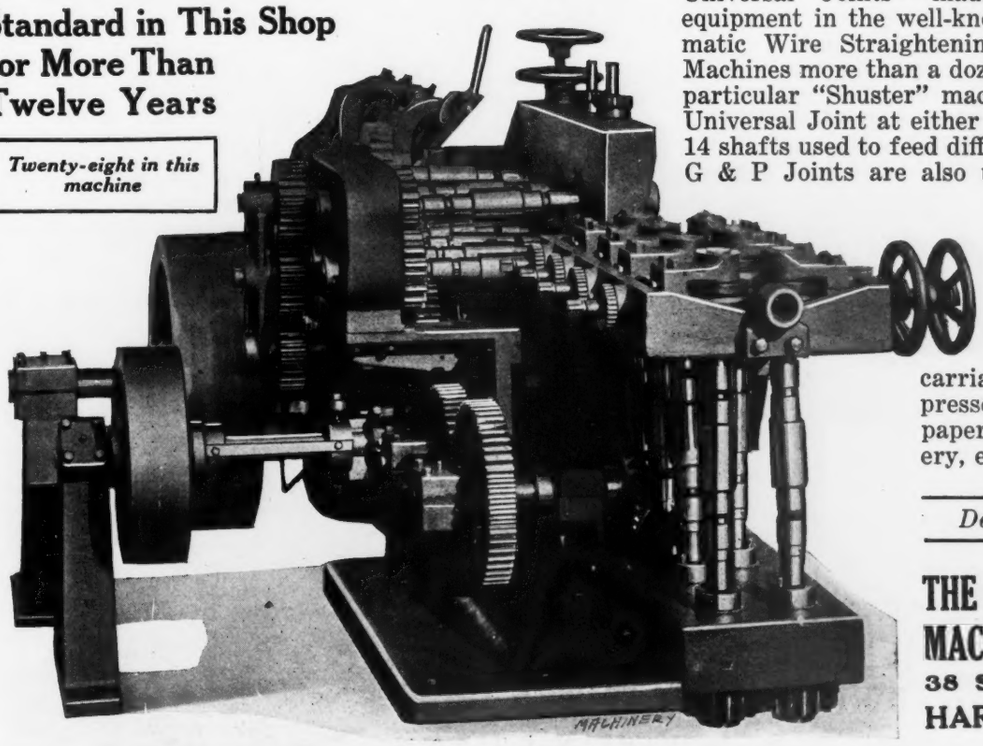
# HŒFER Auxiliary Heads



# G. & P. Universal Joints

**Standard in This Shop for More Than Twelve Years**

*Twenty-eight in this machine*




The F. B. Shuster Co. was one of the first to recognize the advantages of Gray & Prior Universal Joints — made them standard equipment in the well-known Shuster Automatic Wire Straightening and Cutting-off Machines more than a dozen years ago. This particular "Shuster" machine has a G & P Universal Joint at either end of each of the 14 shafts used to feed different sizes of wire. G & P Joints are also used on adjustable gang drills, moving feed shafts of milling, grinding, boring and special machines, for adjusting mechanisms of gun carriages, on printing presses, motor boats, paper handling machinery, etc.

*Details on request.*

**THE GRAY & PRIOR MACHINE COMPANY**
**38 Suffield Street**
**HARTFORD, CONN.**

# NEW BRITAIN SHOP FURNITURE

Designed for *greatest utility*—Built for *longest service*

## Adjustable Shop Stool

*Bulletin No. 1204*

"N-B" Stools are Comfortable; Comfort Induces Efficiency; Efficiency Produces Profits.

Liberal Size Wood Seat.
10" Adjustment.
Spring Back.

The New Britain Machine Co., New Britain, Conn., U.S.A.

# You Don't Need a Special Cutter Grinder

You can easily and cheaply equip your surface grinder or universal grinding machine to do the work just as well.

Takes cutters up to 5" dia. by 1¼" face with holes from ⅛" to 1". (Special washers supplied for larger holes.)

## THE MODERN UNIVERSAL CUTTER GRINDING FIXTURE

The Modern Universal Cutter Grinding Fixture is secured by two simple straps or held down by a magnetic chuck. It holds cutter at any desired angle, vernier assuring accuracy of adjustment.

***Send for complete description***

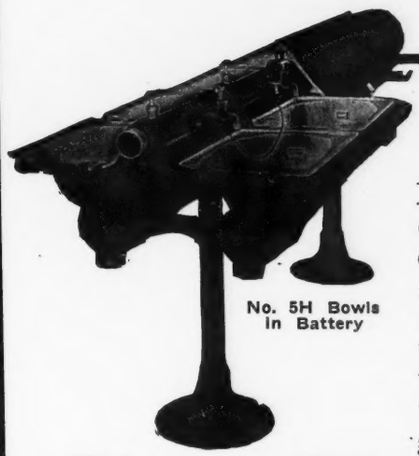
An Angle Head is furnished with the fixture for use in tool work. Exceptionally useful in place of sine bar and V-blocks. Its use for holding templet gages for grinding at various angles will be readily appreciated. The angle head too is equipped with vernier graduations.

## The Modern Tool & Machine Works, Inc.

344-350 Mulberry Street Factory: 5-7 Oliver St. NEWARK, N. J., U.S.A.

# Modern Shop Equipment

## Includes More Than Machinery



No. 5H Bowls in Battery

Don't be like the farmer who buys up-to-date time and labor saving farm equipment, but expects his wife to keep house with the same "conveniences" his great-grandfather installed. High power machinery, efficient transportation, lighting and fire protection systems are only one side of profitable shop equipment. There's a small but important item of goodwill to be considered, which includes not only fair wages to employees but such provision for bodily comfort as will preserve their self-respect and, incidentally their respect for "the boss."

"Meeco" Sanitary and convenient metal shop furniture—individual fireproof lockers, batteries of individual wash bowls with hot and cold water, clean and convenient stock and storage racks—and a clean and refreshing drink "on the house," whenever it's wanted, from *M. E. & E. Ice Cooled Bubbling Drinking Fountains* all stimulate the much desired production to an extent impossible to overestimate.

Fig. 604

Supplies 150 people; holds 75 pounds of ice, 15½ coils ½ inch seamless brass tubing. Attaches to municipal water supply.

**Our Line Includes**

Metal Stock and Pattern Storage Racks, Metal Shelving, Metal Cabinets, Vault Fixtures, Soda Kettles (40 and 60 gallons), Metal Stools and Chairs, Water Mixers, Work Benches, Bench Legs, Full line of Plumbing Fixtures, etc. Send for complete catalog.

***Catalog lists the whole line. Outline your requirements and let us estimate***

MEECO
Metal Equipment For Shop And Factory

**MANUFACTURING EQUIPMENT & ENGINEERING CO.**

***Metal Shop and Factory Equipment Outfitters***

**Office and Showroom: BOSTON, MASS.**

**Works and Mail Address:**
**FRAMINGHAM MASS.**

# Starrett Tools

## Accuracy—an element of speed and economy

With accurate and dependable tools, mechanics can feel confident that work accomplished will be **right.** Greater speed and higher quality work are attained; time also is saved, which ultimately means economy.

Write for Catalog No. 21D. It shows many styles and sizes of these accurate tools that save time and money in the long run.

**The L. S. Starrett Company**
**ATHOL, MASS.**

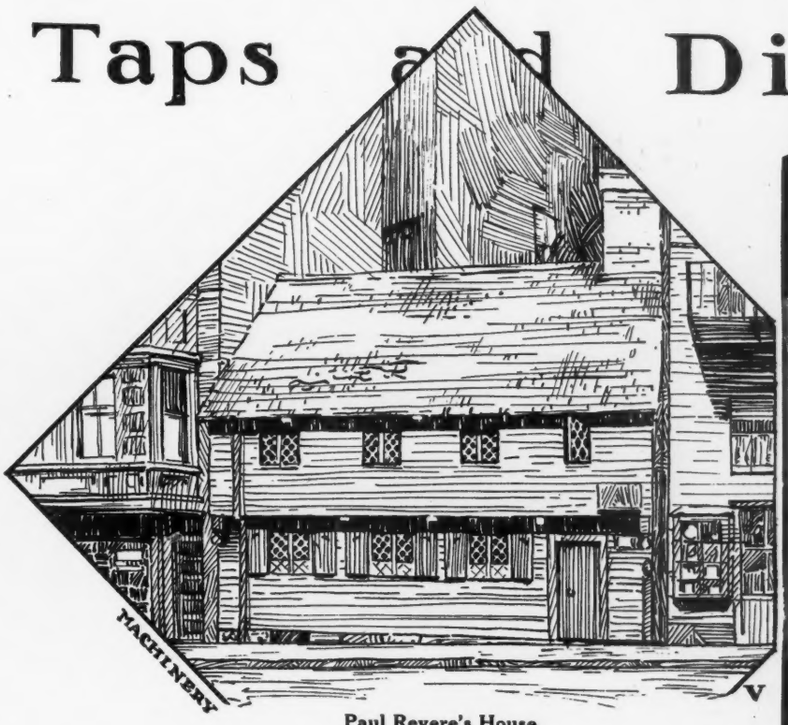
**The World's Greatest Toolmakers**
**Manufacturers of Hack Saws Unexcelled**

**New York** **London** **Chicago**

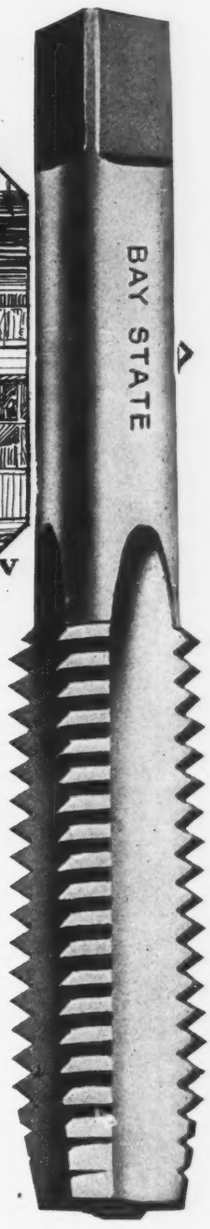
42-909

# BAY STATE

## Taps and Dies




Paul Revere's House
Boston Mass.




## The Utmost in Thread Cutting Equipment

Few landmarks in Boston are of greater interest than the house of the hero of the famous ride—Paul Revere. Standing in one of the city's most crowded quarters, it is a reminder to the people of today that those who went before, played their part in the upbuilding of America.

Could the visions of our forefathers have bridged the gap of time, what changes they would have seen; the country bigger and better—their state a leader in one of the most important of all mechanical industries—the production of tools. "*Bay State.*" We chose our name with as great care as we give to the products which bear it. Bay State Taps and Dies are the utmost in thread cutting equipment. Specify "*Bay State*" with confidence.

## BAY STATE TAP & DIE COMPANY

**MANSFIELD, MASS., U. S. A.**

Representatives for England: George W. Goodchild & Partners, 56-58 Eagle St., Southampton Row, London, W. C.;
Representatives for Scandinavia: Wilh. Sonesson & Co., Ltd., Malmo, Sweden.

NOVO SUPERIOR

# I & Z
## Patent Sections

Stronger than solid tools—for lathe, planer, threading and cutting-off tools. No breakage—No Forging—No Waste.

I & Z Patent Sections save 35 to 40 per cent in weight as compared with solid bars, are more quickly and easily machined, stronger and more durable—practically halve your tool bill.

## NOVO SUPERIOR
### "The Tool Steel without an Equal"

carried in stock in the following sizes:

| Section I | Section Z |
|---|---|
| 3/8 x 3/4 | 3/8 x 3/4 |
| 1/2 x 1 | 1/2 x 1 |
| 5/8 x 1 1/4 | 5/8 x 1 1/4 |
| 3/4 x 1 1/2 | 3/4 x 1 1/2 |
| | 1 x 2 |

## H. BOKER & CO., Inc.

ESTABLISHED 1837

101 DUANE STREET, NEW YORK CITY

Chicago Detroit Boston Cleveland Philadelphia Montreal

PACIFIC COAST REPRESENTATIVES:

Bergen & Carter Co., Pacific Tool and Supply Div.
400 Mission Street, San Francisco, Cal.

# MACHINEBRONZE

*for*

**Automobile and Machinery Construction and Repair**

Solid and Cored Bars in 12" lengths from ½" to 4½" O.D. inclusive, by eighths. Don't wait the convenience of a foundry when you need a bearing. Get Machinebronze from stock. Your machines need not waste good time when a bearing goes bad.

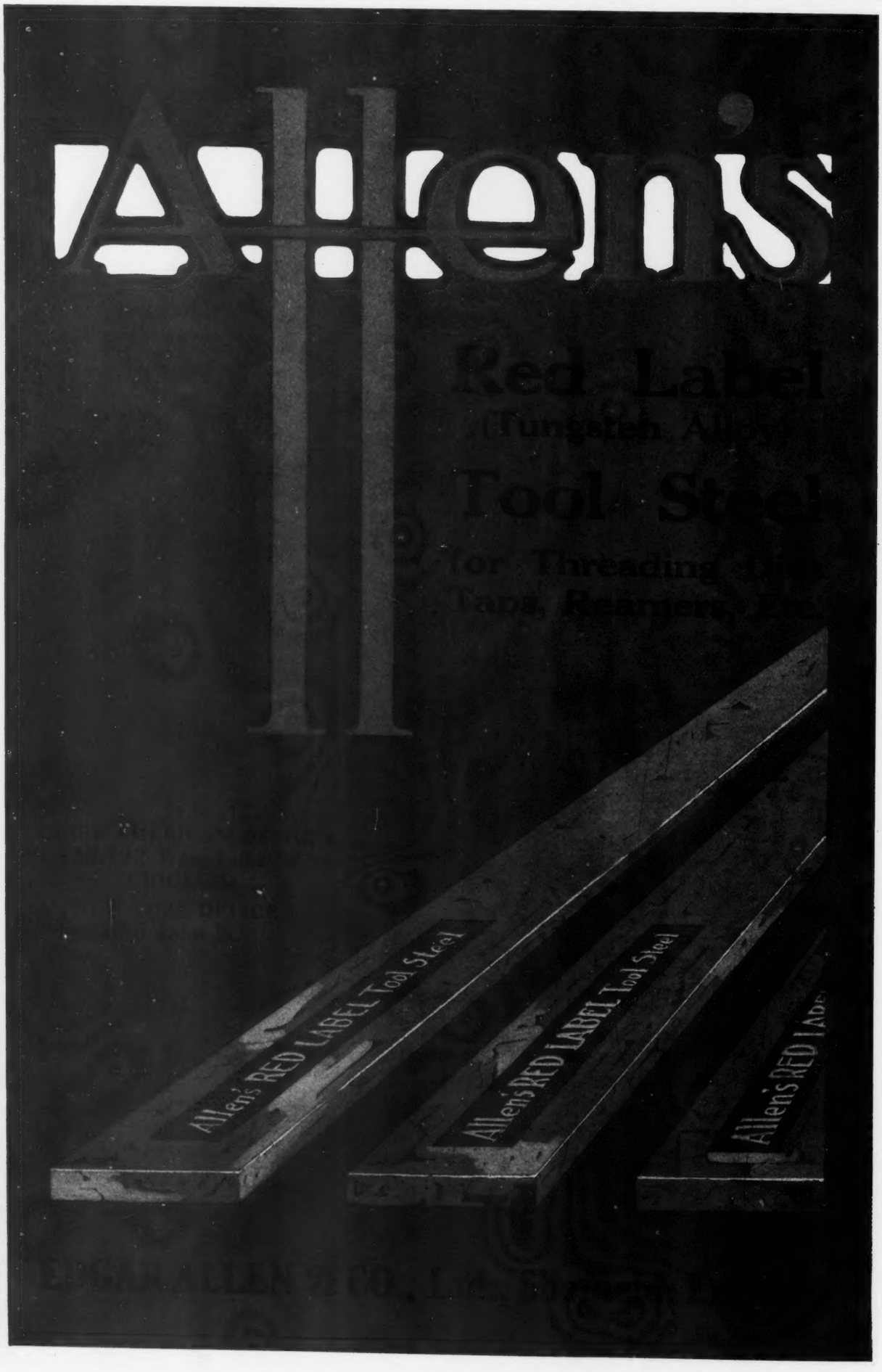
**Machinebronze is always in stock for your convenience at the following distributors:**

The T. B. Rayl Company, DETROIT, MICH.
Chandler & Farquhar Company, BOSTON, MASS.
Sherritt & Stoer Co., Inc., PHILADELPHIA, PA.
Richards & Conover, KANSAS CITY, MO. OKLAHOMA CITY
Smith-Courtney Company, RICHMOND, VA.
Beals, McCarthy & Rogers, BUFFALO, N. Y.
Manning, Maxwell & Moore, Inc., NEW YORK CITY
Badger-Packard Machinery Company, MILWAUKEE, WIS.
E. A. Kinsey Company, CINCINNATI, O.
Machinists Supply Company, CHICAGO, ILL.
Beck & Gregg Hardware Company, ATLANTA, GA.
McMullen Machinery Company, GRAND RAPIDS, MICH.
Cleveland Tool and Supply Company, CLEVELAND, O.
J. Russel Company, HOLYOKE, MASS.
Vermont Farm Machinery Co., BELLOWS FALLS, VT.
Frank Wheeler & Son, MERIDEN, CONN.

**Machinebronze is Guaranteed Free From Melting and Molding Defects**

# LUMEN BEARING COMPANY

**BRASS FOUNDERS** **BUFFALO, N. Y.**


Allen's
Red Label
(Tungsten Alloy)
Tool Steel
for Threading
Taps, Reamers
Allen's RED LABEL Tool Steel
Allen's RED LABEL Tool Steel

# BOEHM DIE HEADS

## Exceptional Care is Given to the Making of Every Part

The photograph of the cam-ring and chaser carrier demonstrates very clearly how the Boehm Die Head chasers open after tripping. The cam engages both sides of the relieved groove in the chaser carrier, and any movements of the cam must have immediate effect on the chasers, be the movement in or out.

Action is POSITIVE, and the quality of threads produced by the Boehm Die Head is such that any inspection other than "lead-tester" or "angle-error" tests, as used on thread gages, is much too coarse. The chasers are really "forming tools" for threads, and these threads must be an accurate duplicate of the chasers. The threads, *cut* as perfectly as is mechanically possible, are safeguarded by the prompt opening of the positively engaged chaser-carriers with the cam.

**RICKERT-SHAFER COMPANY**

**612 West Twelfth St.** New York Office: 50 Church St. **Erie, Pa., U.S.A.**

# Stel

## NOT STEEL —

Mr. Manufacturer, how big is your factory?

You cannot measure it in terms of acres, or of dollars invested, but in terms of production.

You can increase your production by adding more men, more machines, more power, more expense—or you can increase it by using Stellite.

The adoption of Stellite tools has made bigger plants all over America. They are speeding up production wherever they are in use. They are saving time. They are saving money.

Stellite is an investment, paying tremendously big and certain returns. Increased capacity invariably comes through its use.

Stellite tools cut best at red heat—where tools of high speed steel break down. They are harder than steel tools, and have high

***The Haynes***

**Home Office and Plant**

**Kokomo, Indiana**

tensile strength. They can be worked much faster than high speed steel and can take heavier cuts.

Stellite is immune to heat up to 1800 F. Up to that point, the hotter Stellite tools get, the tougher they get, and the better they cut.

The output of your machine shop is limited to the speed with which you can operate your lathes. Bear in mind these facts:

Stellite tools can be worked faster than high speed steel.
Stellite tools can take heavier cuts.
Stellite tools last longer between grindings

Stellite is a nationally-known product, the standard cutting metal in many of the largest plants of America. Stellite is ***not*** steel, but the ***master*** of steel.

We will furnish further details gladly.

Patentees and Sole Manufacturers.

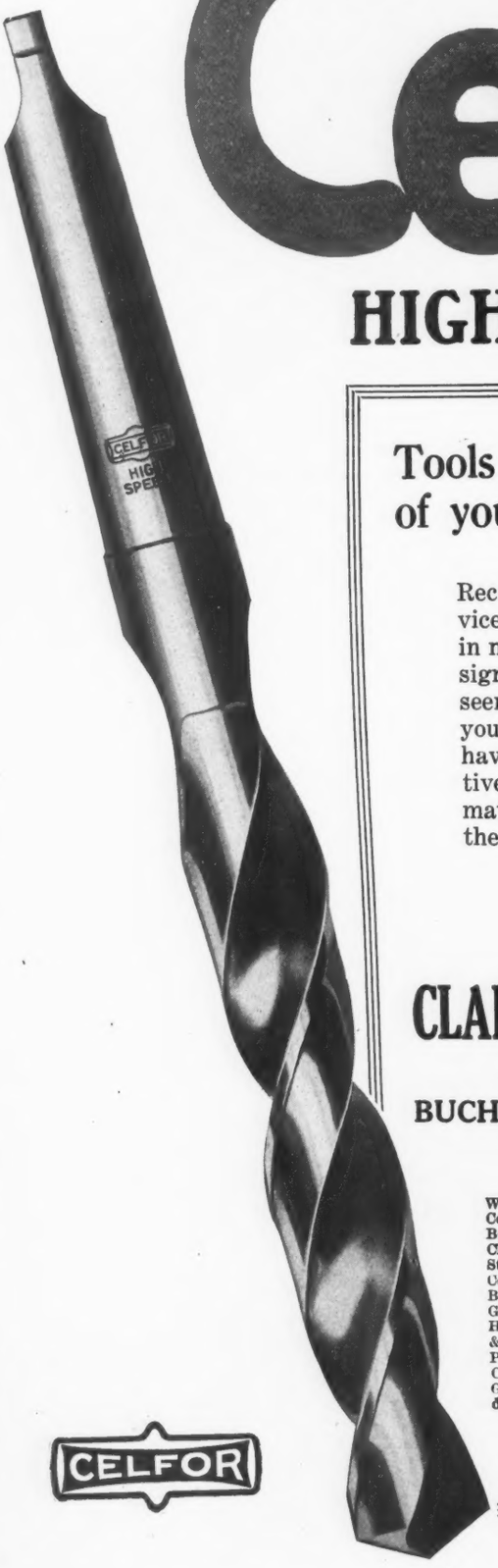
## *Stellite Company*

**Eastern Offices**

**120 Broadway, New York**

# Celfor

## HIGH SPEED DRILLS




### Tools you can drive to the limit of your High Powered Machines

Records for long, hard, cost cutting service have made Celfor Tools the standard in many railroad shops, where they are assigned to the hardest jobs. Once you have seen Celfor High Speed Drills in action, you'll appreciate the reason for this. They have unusual chip clearance and a distinctive twist that make them more than a match for the most powerful machines on the market. Try them.

*There's a new Celfor Catalog*
*Write for your copy to-day.*

## CLARK EQUIPMENT COMPANY

*Successor to Celfor Tool Company*

**BUCHANAN MICH., U.S.A.**

WHERE CELFOR TOOLS ARE SOLD: Dale Brewster Mchy. Co., Chicago, Ill. Manning, Maxwell & Moore, Inc., New York, Boston and Philadelphia. Machinists Supply Co., Pittsburgh. Clark, Witbeck Co., Schenectady. H. D. Taylor Co., Buffalo. Stirling-Warfel Mill Supply Co., Erie. The W. M. Pattison Supply Co., Cleveland. National Supply Co., Toledo. Everett Moses Co., Birmingham. The E. A. Kinsey Co., Cincinnati and Indianapolis. Geller, Ward & Hasner Hardware Co., St. Louis. Oliver H. Van Horn Co., New Orleans. Robinson, Cary & Sands Co., St. Paul & Duluth. J. C. Dolan, Denver. Seattle Hardware Co., Seattle. Pacific Tool & Supply Co., San Francisco and Los Angeles. Canada: Rudel-Belnap Machinery Co., Montreal and Toronto. Great Britain: The Coats Machine Tool Co., Thanet House, London. Japan: Andrews & George, Tokyo.

# KETOS

## MAINTAINS ACCURACY

*The Only Steel they Dare Use for*

## Curtiss Engine Master Gages

For making Curtiss airplane engines the Willys-Overland Company has evolved in its Elyria, Ohio, plant, an elaborate system of tools and gages to insure perfect interchangeability. Thread gages—ring and plug — expansion taps and dies, in fact, all tools required not to shrink or warp in hardening are made of Ketos Steel. "Ketos Steel," says the toolroom foreman, "is the only oil hardening steel we can use. We can always depend on it." Consider the requirements for Curtiss engines—consider your own requirements.

*Shall we send information that will assist you in ordering?*

**HALCOMB STEEL CO.**
**SYRACUSE, N. Y.**

BRANCHES: New York Chicago Philadelphia
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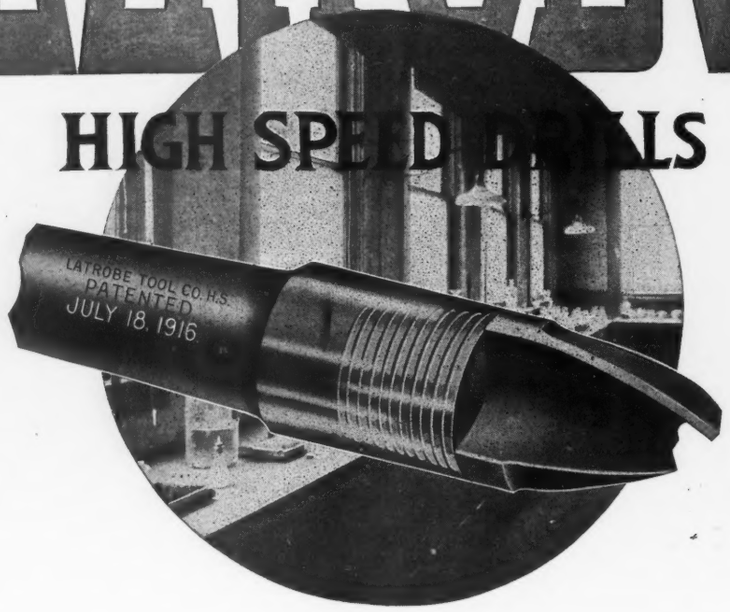
# Latrobe

## HIGH SPEED DRILLS



## *Practically and Scientifically Correct*

### *ALL* **Latrobe** *DRILLS ARE MILLED*

The selection of material for **Latrobe** Drills is of vital importance—Only the finest quality SPECIAL SECTION HOT ROLLED HIGH SPEED STEEL is used This steel is manufactured especially for **Latrobe** Drills, and adopted only after a series of exhaustive tests.—It is a high speed steel particularly suited to hard service, consequently, due to the steel used, and method of their construction, **Latrobe** Drills will resist severe torsonial strain and will overcome inequalities in the material being drilled.—They are High Speed Drills in every sense of the word— **Latrobe** Drills have all the reserve strength of a forged drill plus the accuracy of a milled drill

LOOK FOR THE NAME **Latrobe** ON THE SHANK

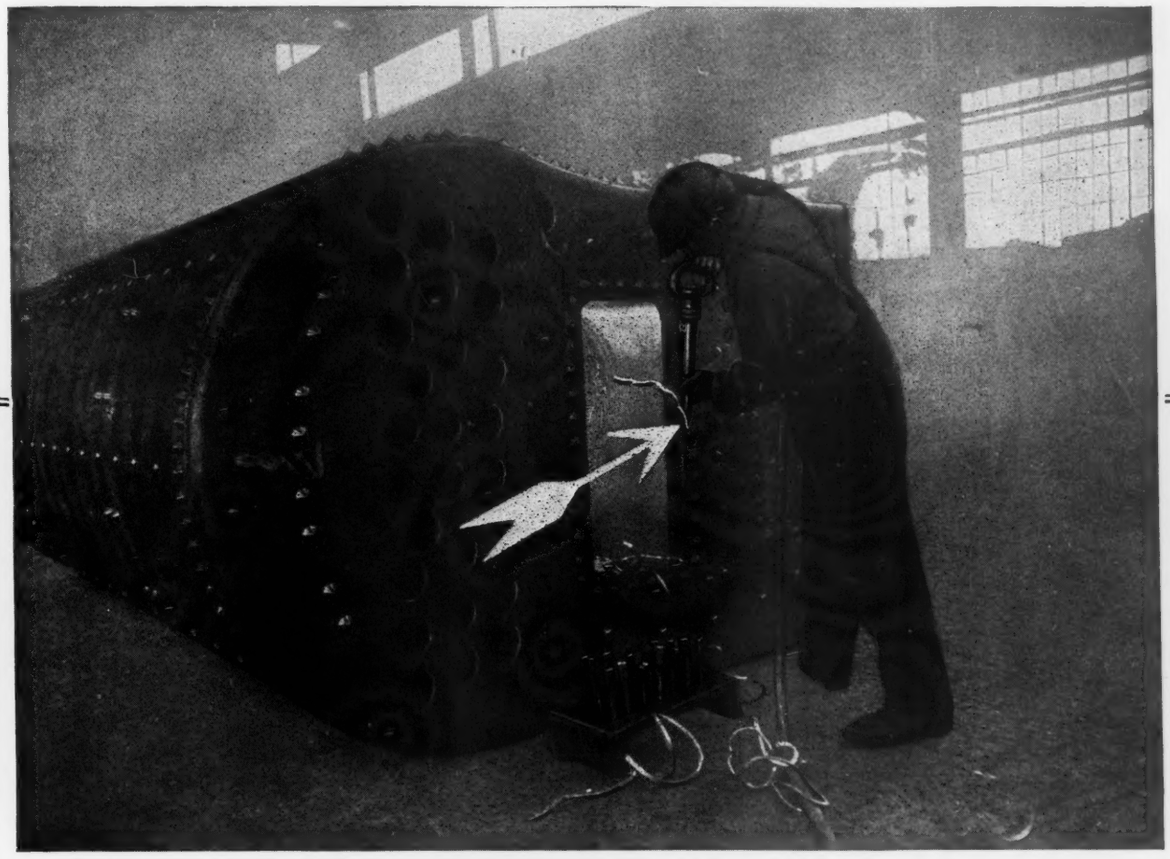
# LATROBE TOOL CO.

MANUFACTURERS

LATROBE, PENNA.

**The hot rolling of this special high speed steel section compresses the steel in the center, therefore when the drill is twisted the toughest portion is in the exact center.**

**FOUR FLUTE SPIRAL REAMER**



# VULCAN SPECIAL VANADIUM CHISEL STEEL

## Look at the chip it cuts! ½ in. to ⅝ in. thick.

Some of the chisels in the rack have been in service over a year. They are used especially for the difficult task of trimming the firebox, and turning short corners—work which is most severe on the corners of the chisel. But *they do not break!*

They say Vulcan Special Vanadium Chisel Steel gives far better results than any other chisel steel they have ever used.

***Do YOU use Vulcan Special Vanadium?***

**Vulcan Crucible Steel Co.**

**ALIQUIPPA** *Established 1900* **PA., U. S. A.**

**Makers of Wolfram High Speed Steel**

BRANCHES:

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[illegible] 1618 S. Clinton Street Newark, N. J. 52 No. 11th Street
[illegible] 550 Penobscot Bldg. St. Louis International Life Bldg.

WOLFRAM MADE IN THE U.S.A. HIGH SPEED STEEL TRADE MARK

# STANDARD
## Machine Keys

We carry a complete stock of finished machine keys, including keys for the Woodruff System. Prepared to fill special requirements.

OUR product is so widely and favorably known that it is hardly necessary to emphasize quality. We wish to announce, however, that increased facilities have enabled us to handle a bigger volume of business, to insure quicker deliveries and to offer most reasonable prices. Send your orders to us and *insure* satisfactory results.

**Standard Gauge Steel Co.**

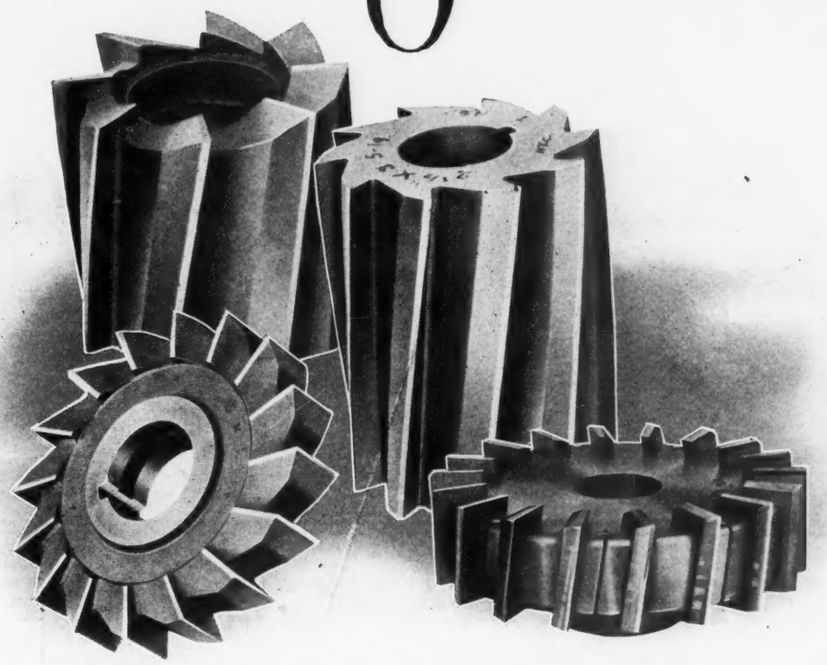
**BEAVER FALLS PA., U. S. A.**

BRANCH OFFICES:

CHICAGO, ILL. PHILADELPHIA, PA.

MACHINERY

# National-Cleveland Cutting Tools



It ought not be hard to think of National-Cleveland when you are ordering cutting tools. Just keep N-C in mind. N-C has a particular significance to us Americans. These initials, because of a recent history-making event, at once suggest speed, endurance, reliability, progressiveness—superiority.

All these qualities are attributive to National-Cleveland Cutting Tools. Thus, think of N-C—and what it stands for—when ordering cutting tools.

*Monthly stock bulletins—are YOU getting them.*

## NATIONAL TOOL COMPANY

**CLEVELAND, OHIO**

**Chicago Sales Room:**
**26 S. Jefferson Street**

**Philadelphia Sales Room:**
**40 N. 7th Street**

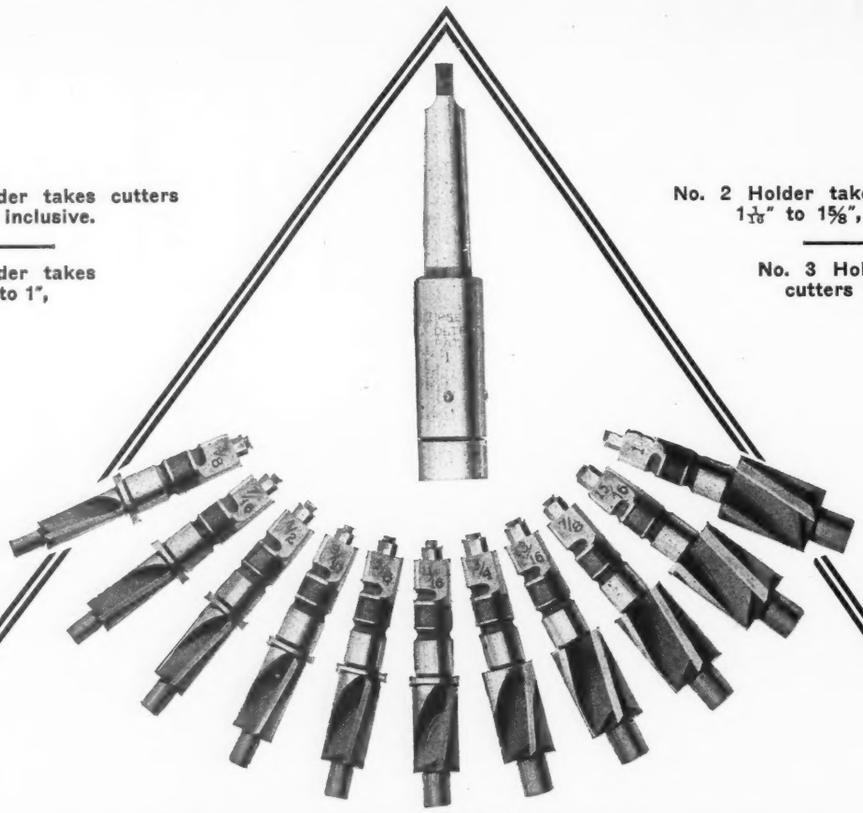
**New York Office: Room 553, 50 Church Street**

**European Office: The National Tool Co., 139 Queen Victoria Street, London, E. C.-4**

# ECLIPSE

No. 0 Holder takes cutters ¼" to ⅜", inclusive.

No. 1 Holder takes cutters ⅜" to 1", inclusive.



No. 2 Holder takes cutters 1 1/16" to 1 5/8", inclusive.

No. 3 Holder takes cutters 1 11/16" to 3", inclusive.

Patented Feb. 6, 1917

## INTERCHANGEABLE
# COUNTERBORES

Have proven their SUPERIORITY over all other Counterbores and Spot-Facers, to over 90% of the LEADING MANUFACTURERS **who are in BIG PRODUCTION,** and TO THE UNITED STATES GOVERNMENT.

## ECLIPSE INTERCHANGEABLE COUNTERBORE COMPANY
## DETROIT, MICHIGAN

*WRITE FOR CATALOG, PRICE LIST AND DISCOUNTS*

MANUFACTURERS OF

ECLIPSE Interchangeable **COUNTERBORES.**
ECLIPSE Interchangeable **COUNTERSINKS.**
ECLIPSE Interchangeable **CORE DRILLS.**
ECLIPSE Interchangeable **BACK-FACERS.**
ECLIPSE Interchangeable **SPOT-FACERS.**
ECLIPSE Adjustable Length **HOLDERS.**

# COLTON-DETROIT HIGH SPEED DRILLS

IF we were to insinuate that the work you are performing is no different from that which any other manufacturer is doing, the exception you would probably take would be surely justifiable. In view of this, we wish to assert that we, too, are producing certain things which we believe—based on what we are told—are superior to most others of similar nature.

Doesn't it seem logical, then, that Colton-Detroit High Speed Drills—superior tools—would help in maintaining the quality distinctive of the work you do?

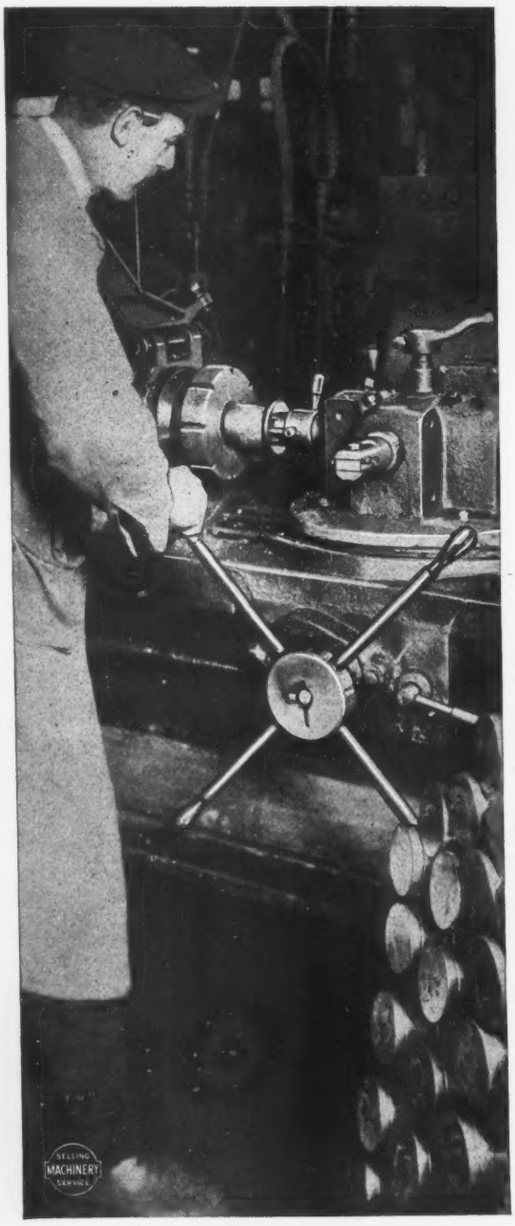
COLTON DETROIT

*Our catalog is more than a list of figures. We'll appreciate your asking for it.*

## ARTHUR COLTON CO.

**785 Jefferson Ave., East**
**DETROIT, MICHIGAN**

**30 Church Street, New York City**
**75 Fremont St., San Francisco, Cal.**



# MURCHEY
## Collapsing Taps

### *There's One for Every Job*

Murchey Collapsing Taps are made in sizes to suit practically every job for which a collapsing tap is advisable.

There are three styles—Lever Handle, Sliding Collar and "Pull Off" type. An adjusting pin on the bottom of each tap makes it possible to work within limits of a thousandth of an inch without difficulty.

Murchey Taps require no reversing—chasers recede on completion of cut, and tool is withdrawn instantly.

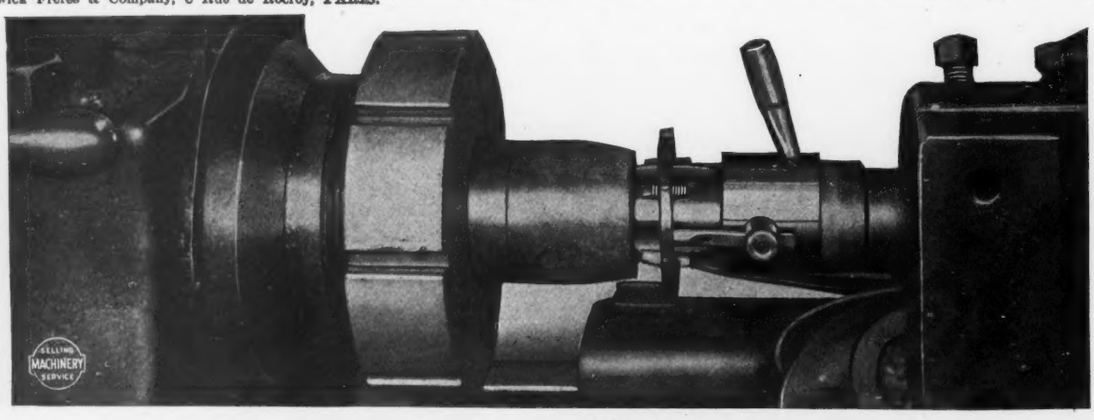
Murchey Collapsing Taps and Expanding Die Heads are in extensive use in many of the best plants throughout this and other countries. They are correct in principle, are made of superior materials, workmanship is of the best.

Murchey Collapsible Taps 1″ to 12″. Murchey Self-Opening Die Heads ¼″ to 8″. Their reputation is established.

## MURCHEY MACHINE AND TOOL CO.

**34 PORTER STREET** **DETROIT, MICHIGAN**

Great Britain, Ireland and British Colonies, Coats Machine Tool Company, Limited—LONDON—NEWCASTLE-ON-TYNE—GLASGOW. France: Fenwick Freres & Company, 8 Rue de Rocroy, PARIS.



# ILLINOIS

## CUTTERS
## REAMERS

*None better can be made.*

## ILLINOIS TOOL WORKS, CHICAGO.

**Detroit Store—**
Woodward and Warren Aves.

**A. C. Towne, Inc.**
17 W. Swan St., Buffalo.

**S. J. Pfaff**
Pioneer Bldg., St. Paul.

**Rose Tool and Supply Co.**
111 Market St., Pittsburgh.

**Louis G. Henes**
75 Fremont St., San Francisco.

Title Insurance Building
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**Indianapolis Office**
616 Fletcher Sav. & Trust Bldg.

**New York Office**
141-145 West 36th St.

**Andrews & George Company, 16 Takegowa-cho, Kiobashi-ku, Tokyo, Japan.**

# Pick Your Wrenches from the "W&B" Line

WE make a larger variety of wrenches than any other manufacturer in the world.

Save money, time and freight to the buyer by making combination shipments.

Quality, Strength and Service guaranteed by 65 years of uninterrupted experience in manufacturing tools, with the policy of:

***"Make it better than anyone else can make it, put your name on it and stand by it."***

Trade Mark Registered U. S. Patent Office

**The Whitman & Barnes Manufacturing Company**

**General Offices: Akron, Ohio**

Factories: Akron, O., Chicago, Ill., St. Catharines, Ont.
European Office: 139 Queen Victoria St., London, E. C.

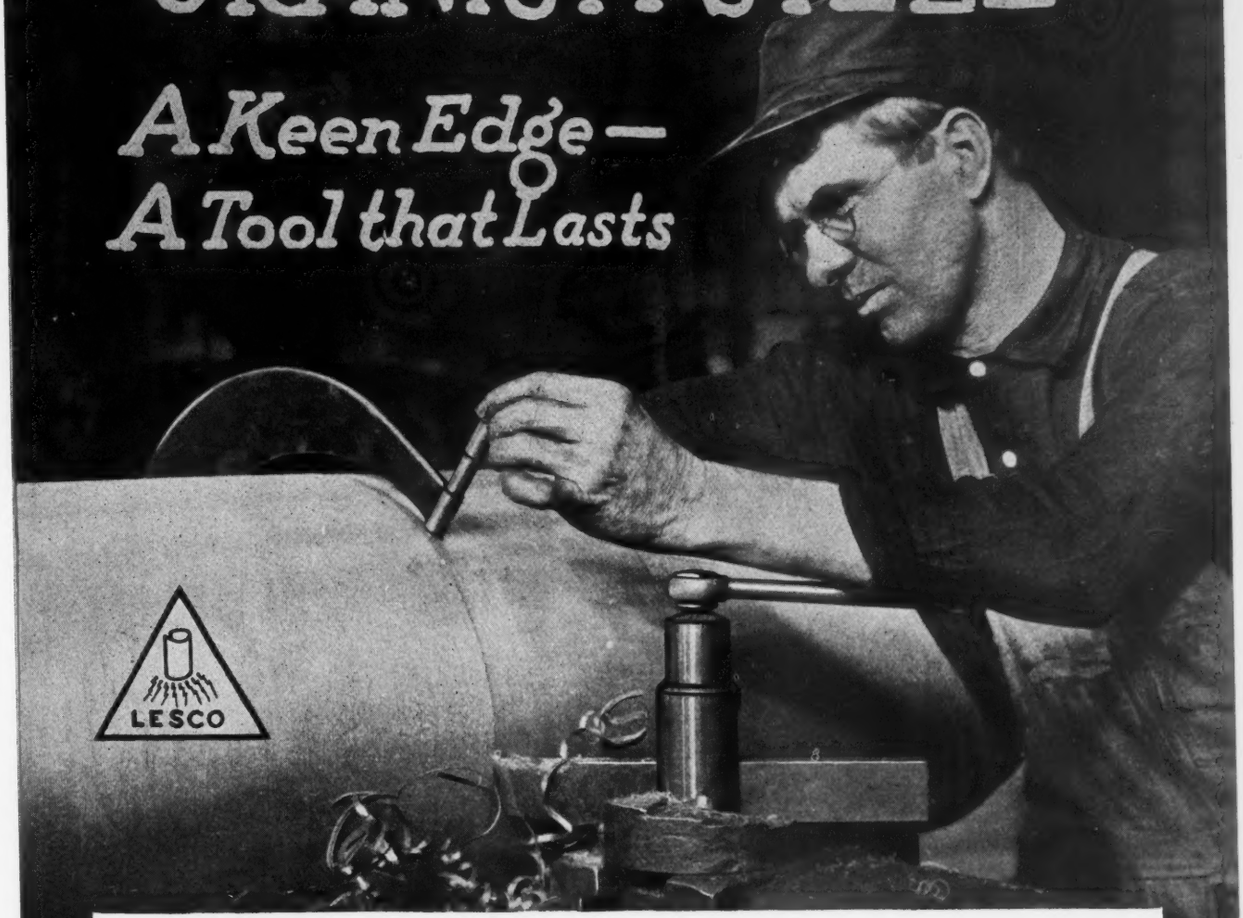
**Established 65 Years**

# Whitman & Barnes

**TWIST DRILLS — REAMERS — WRENCHES — DROP FORGINGS**

# LATROBE ELECTRITE URANIUM STEEL

## *A Keen Edge— A Tool that Lasts*




THE ability to take finishing cuts at high speed is as important as the qualities which enable a tool to stand up under the coarse feeds and heavy cuts of roughing operations.

Latrobe Electrite Uranium Tools take an *edge that lasts.* Try them for heavy roughing cuts or for the final finishing which brings the work to uniform diameter with an almost polished finish. Latrobe Electrite Uranium Tools give satisfactory service; they harden without risk, machine easily after annealing and retain a fine cutting edge on difficult work.

***A trial order will convince you***

## LATROBE ELECTRIC STEEL COMPANY

**LATROBE, PENNSYLVANIA, U. S. A.**

**SALES OFFICES:**

New York, 165 Broadway.
Pittsburgh, Pa., First National Bank Bldg.
Cincinnati, O., 2802 Union Central Bldg.
Detroit, Mich., 1531 Dime Bank Bldg.
Toledo, Ohio, 248 Water Street.
Oil City, Pa., 557 Chambers Bldg.
Erie, Pa., 15th & Ash Streets.
Buffalo, N. Y., 512 Ellicott Square Bldg.
Cleveland, O., 1306 Union Nat'l Bank Bldg.
Washington, D. C., Riggs Bldg.
Seattle, Wash., 536 First Avenue So.
Los Angeles, Cal., American Bank Bldg.
San Francisco, Cal., 149 California St.
Dayton, Ohio. 1105 Conover Bldg.
Philadelphia, Pa., Widener Bldg.
Winnipeg, Canada, 307 Confederation Life Bldg.
Chicago, Ill., 572 West Randolph St.
St. Louis, Mo., 810 Security Bldg.

Sheffield

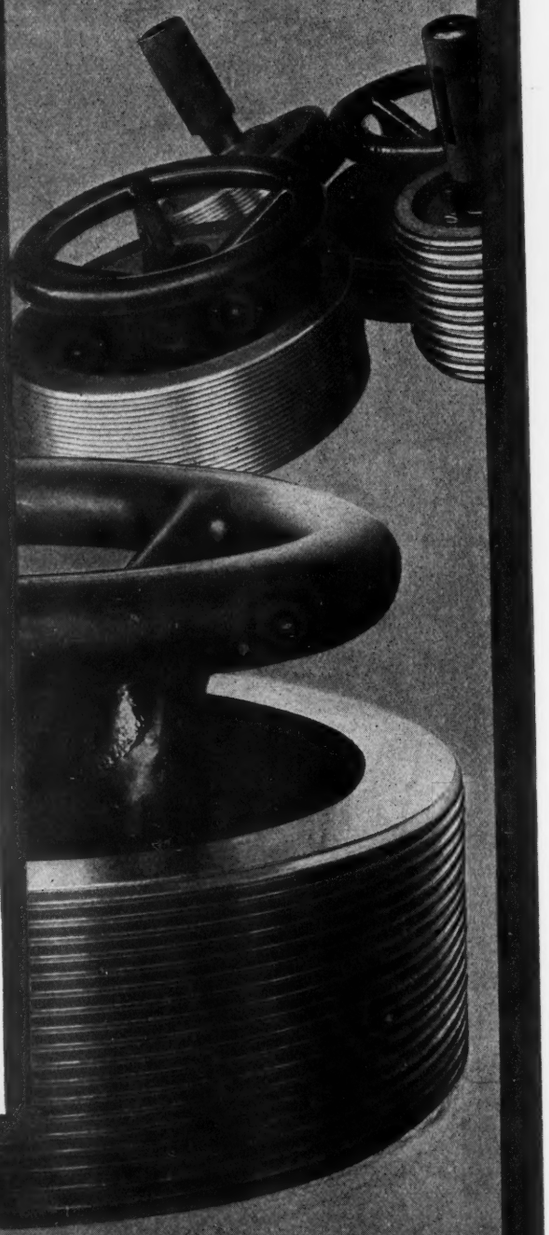
# Thread Gages

Keeping everlastingly at it brings success. Square and irregular holes can at last be drilled—an oval drawing compass, long a target for genius, is probably not impossible.

Thread gage grinding and testing, but recently uncertain, is today achieved.

The Sheffield organization has specialized in the making of thread gages.

Successful selling of successful work has been due to reasonable prices and quick deliveries. Investigate.



The Sheffield Machine & Tool Company

Dayton, Ohio, U. S. A.

# Making Production Men Sit Up and Take Notice

You can't judge a tool by an occasional fine performance. But no production man can ignore the long series of extraordinary service records made by

# DAVIDSONIZED High Speed Steel Tools

Here's another recent performance, stripped to the naked facts (name of plant on request):

Clevis Milling Job. Four side-milling cutters on arbor, each 6 in. x ½ in. x 1 in. Material: High Manganese Carbon Steel, forged stock. Standard production speed, 150 pieces per 8 hour day. Best previous tool performance: 800 to a grinding.

In the competitive test, the two outer cutters on the arbor were Davidsonized Tools, and the two inner ones of a well-known standard make.

The first set of inner cutters had to be taken off after 726 pieces, the second set did 750. After these 1476 pieces, at which point the test was discontinued, both Davidsonized Cutters were still in practically as good condition as at the start.

Apply this comparison to some job of your own and see what it would mean to you in terms of your own costs. Figure not only getting out the same work with one-half the number of cutters, but the saving in the overhead and labor items through reduction of take-down and setting-up time. Then write us for further particulars, or say when our representative may call.

## THE DAVIDSON TOOL MFG. CORPORATION

**Main Office: 118-122 Maiden Lane, New York**
**Works: 56-62 North 6th Street, Brooklyn, N. Y.**

*In Canada—The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Winnipeg*
*In Scandinavia—Aktieholaget A. Bonthron, Stockholm, Sweden.*

## *Special Service*

***To Concerns Who Make Their Own Tools***

We will supply Davidsonized High Speed Steel Blanks, semi-finished to within approximately .015 to .020, either soft annealed or hardened.

# LOVEJOY
## INSERTED CUTTER TOOLS

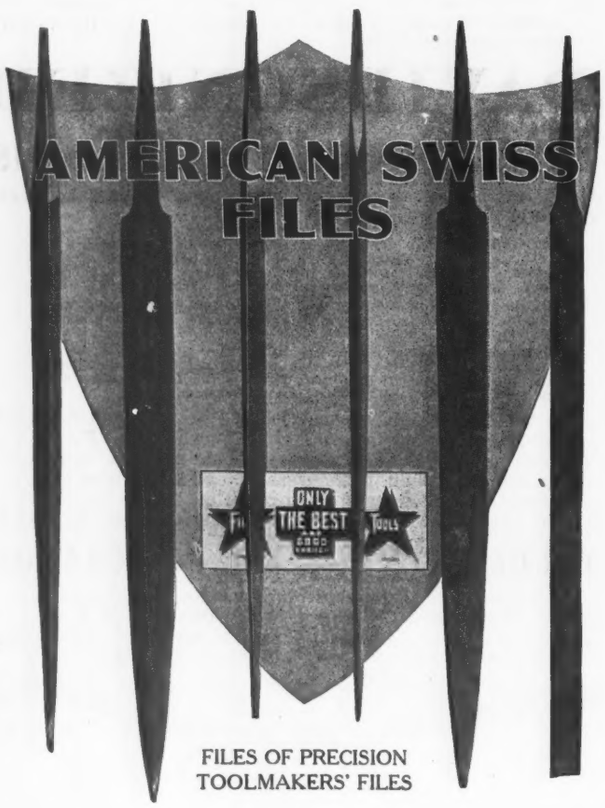
Here is a workman waiting for a cutting tool; both he and his machine are idle. The blacksmith is spending his time on a job he never should be handed in the first place—and his helper waits.

### Why Wait for the Blacksmith?

Now, glance at this Lovejoy Inserted-Cutter. The cutting tool and the crossbar with their interlocking serrations, are held in a wedge grip by the piece in the man's right hand. The small crossbar (left hand) is just being put in place. The whole adjustment, taking but a moment, is made entirely by hand, and is as strong as a solid piece of metal.

*Lovejoy Inserted Cutter Tools save time labor and materials. Ask us about them*

**THE LOVEJOY TOOL CO., Inc.**
SPRINGFIELD VERMONT




FILES OF PRECISION
TOOLMAKERS' FILES

## "ONLY THE BEST ARE GOOD ENOUGH"

Not every toolmaker is blessed with the deft fingers of the old Swiss artisans, but the *precision* of American Swiss Files makes up the deficiency. The ultimate in refinement and accuracy, these files of precision are the national standard for fine filing—the choice alike of America's skilled mechanics and American manufacturers, who look for quality as well as profit.

American Swiss Files—made in America, from American materials, by American methods, give invariable satisfaction and can be accurately duplicated.

*Specify "American Swiss"*

**AMERICAN SWISS FILE AND TOOL COMPANY**
E. P. REICHHELM & CO., Inc.
Selling Agents
24-26 JOHN STREET NEW YORK

# PRODUCTION

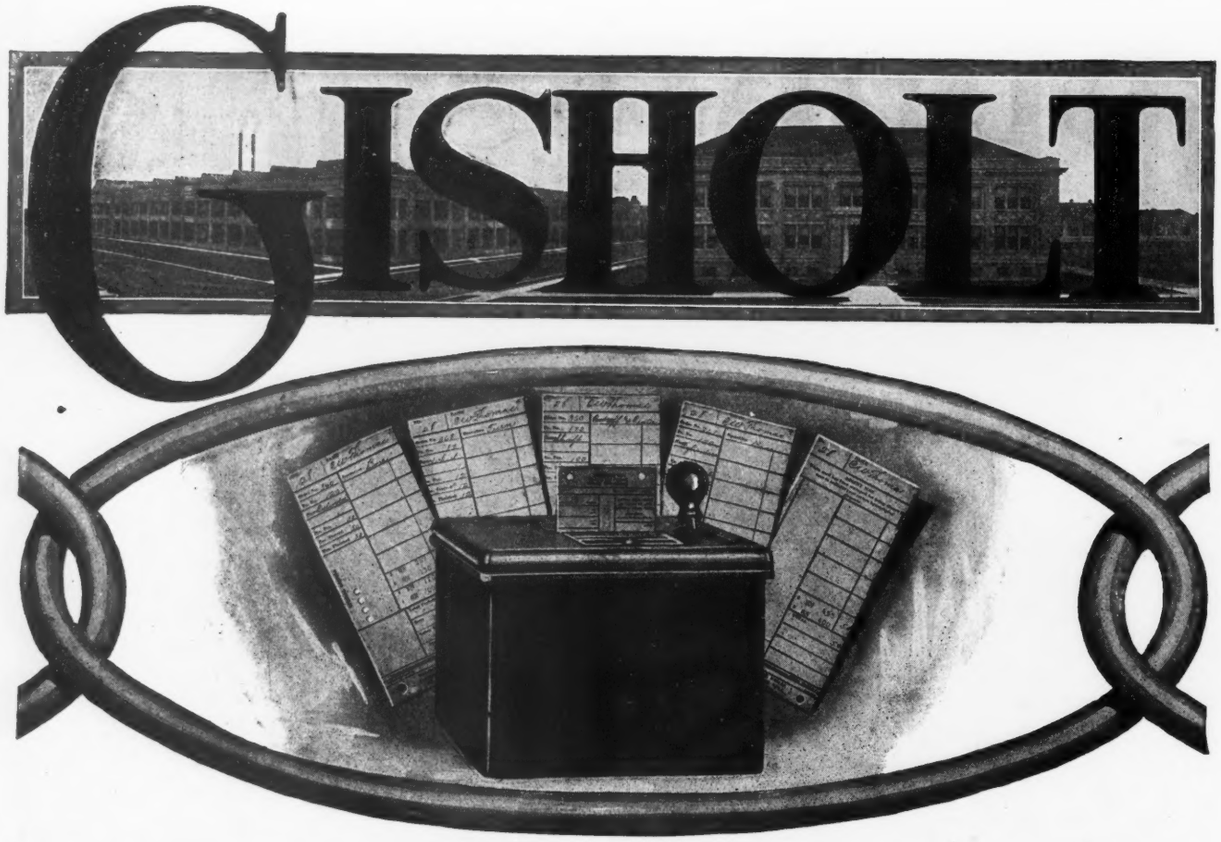
# Is Our Slogan

*Send for catalog J-3*

**PROMPT DELIVERIES**

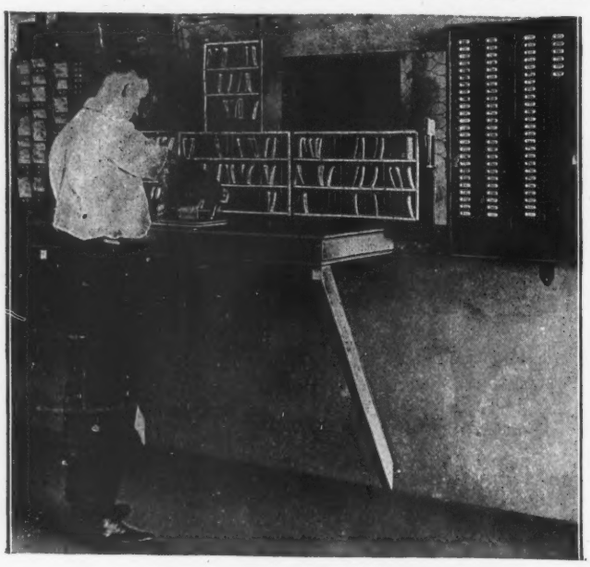
## THE KELLY REAMER COMPANY

**CLEVELAND** **OHIO, U. S. A.**




# THE PERIODOGRAPH

## FOR TIME RECORDING IN FACTORIES



A necessary link in *your* shop to strengthen your factory management and control.

Periodograph time tickets give you an *accurate record of attendance, quick and accurate time recording of jobs and the necessary facts with which to aid production.*

Let the Periodograph supply the necessary link to connect you with better shop control and simplified, less expensive cost accounting.

*Write for the Book, "Better Factory Control"*

GISHOLT MACHINE CO., 9 S. Baldwin Street MADISON, WIS., U. S. A.

*Builders of Standard and Automatic Turret Lathes; Vertical and Horizontal Boring Mills, Tool Grinders, Small Tools, Special Machinery, etc.*

*Eastern Sales Office:* 30 Church St., New York *Works:* Madison, Wis., Warren, Pa.

*Agent:* F. A. Thomas Company, San Francisco, Cal.

*Gisholt Methods Insure Accuracy & Economy*

# Statements of Importance to Truck Buyers

THE following group of statements made by The White Company in recent advertising summarizes the achievements of the White Product—the White fleet growth, mileage records, honors won in commerce and war; reviews the factors of strength and permanence back of every owner's investment in White Trucks.

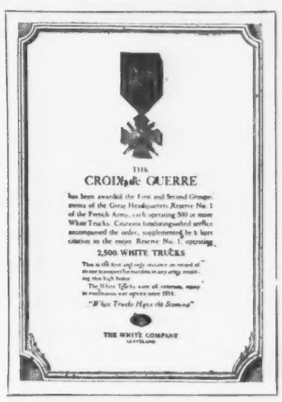
All bear on one simple fact: the real value of a motor truck; its *ability to do the most work for the least money under all conditions.*

"Year after year this list grows. It is something more than a list of well-known concerns owning ten or more White Trucks. It represents *a yearly progress in added trucks per owner*—the most extensive growth of individual fleets ever published by a truck maker.

"There are now 2774 White Fleets in actual service, totaling 33,139 trucks, exclusive of all single truck installations."

"The ultimate mileage of White Trucks is still unmeasured. Some have rounded out 300,000 miles. Many have run 200,000 miles. Hundreds, probably thousands, have passed the 100,000 mark—a very common White performance."

"The purchaser of a White Truck backs his investment in it with the strength of The White Company, with its years of successful experience, with its thousands of trained employees, with its tens of thousands of trucks in active service, with its millions of capital and a service organization, nation-wide, which has no parallel in the industry."




*The complete statements, in pamphlet form, will be sent upon request*

THE WHITE COMPANY
CLEVELAND

# "AT ONCE"

That is the way they demand
and that is the way they get

# ERIE CRUCIBLE STEELS

"The Product of Two Generations"

## ERIE CRUCIBLE STEEL COMPANY

ERIE, PENNSYLVANIA

New York and Philadelphia Agents:
Tidewater Steel Products Corp.
149 Broadway, New York City

Chicago—1816 Fisher Building
Detroit—858 Penobscot Building

## EDGAR T. WARD'S SONS CO.

OFFICES AND WAREHOUSES

BOSTON 40-54 FARNSWORTH ST. | NEW YORK 304 HUDSON ST. | NEWARK 394 FRELINGHUYSEN AVE. | CHICAGO 3604 SOUTH MORGAN ST. | PHILADELPHIA 16th & INDIANA AVE.

***Tools and Alloy Steel for Delivery from Warehouses***

**GOLD LABEL High Speed Steel**
**TEENAX Non-Shrinking Die Steel**
**WARD'S Standard Tool Steel**
**WARD'S Best Cast Steel**

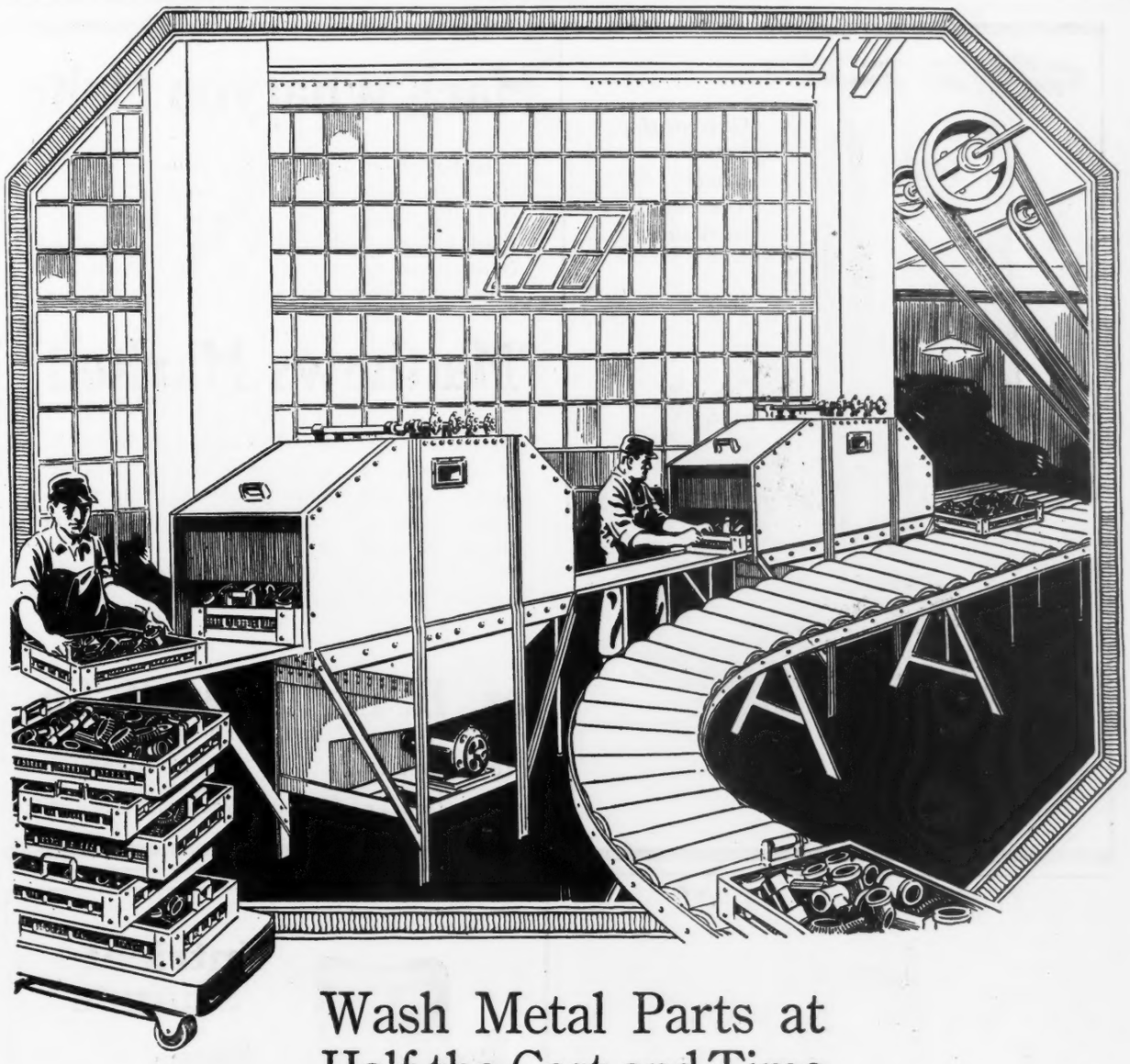
**Complete Stocks of all the above grades carried at all warehouses. This entire line consists of the highest quality of the American steel makers, each grade the best for its particular purpose.**

**We invite your closest investigation if looking for the most uniform and economical steels for increased production.**

***Write Nearest Office***

BRANCH SALES OFFICES

CLEVELAND 416 CITIZENS' BLDG. | DETROIT 403 VINTON BLDG. | MILWAUKEE 505 FIRST NATIONAL BANK BLDG. | ST. LOUIS 418 COMMERCIAL BLDG.



# Wash Metal Parts at Half the Cost and Time

## *What NIVIN Users Say:*

*From an International Harvester Plant the production chief reports:*

"The Nivin Metal Parts Washing Machine in our plant does in half a day work that formerly required a full day's labor. But even if it didn't save any time at all the NIVIN does the work so much better that I would install it on that account alone."

*NIVIN saves Time, Labor and Supplies for Hamilton-Beach Mfg. Co., Racine, Wis.*

"NIVIN gives us A-1 service. It does in half the time the work it previously required two men to do. In addition to saving time and labor the NIVIN enables us to clean our parts without using gasoline, thus bringing our cost down considerably."

*NIVIN does excellent work at One-sixth of Chemical Cost at Cleveland Hardware Co. plant*

"The NIVIN does the work quickly and very satisfactorily. On our principal item the NIVIN uses 6 lbs. of Platers Cleaner per week. Under the old method we used this amount daily."

**NIVIN**

**METAL PARTS WASHING MACHINE**

Does away with Open Tanks, Hand Labor and Wet Floors.

Does away with Gasoline.

*Cuts Time and Labor Cost in Half.*

Every NIVIN-washed product is washed perfectly clean from the first to the last.

Made in flexible units—fits in any factory system.

## *Write for Literature*

Write today for our literature giving specifications and full details of the operation of the Nivin Metal Parts Washing Machine. This information is valuable to you. You put yourself under no obligation by asking for it. Write for our literature today.

**The Nivin Manufacturing Co.** 840 Larrabee Street Chicago ∴ Illinois

*Our catalog lists the whole line—copy on request.*

# Mark what you Make

Whether your products are reamers or rolling mills, scissors or steam engines, be sure that they carry your name in clear, easily read letters *that will be legible when the time comes to reorder.* In other words, be sure your goods are

# "Matthews Marked"

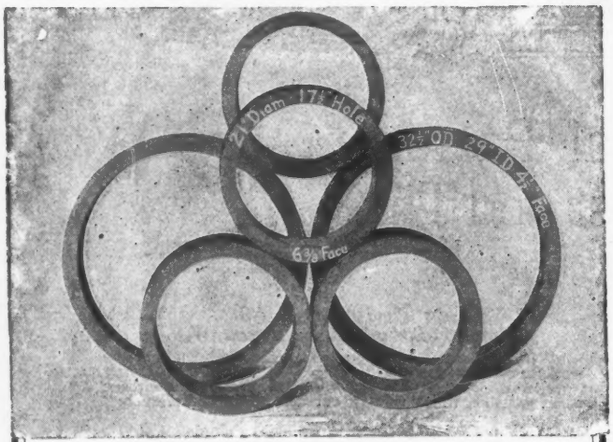
Matthews Marking Devices are reliable. They cover the field, from a small rubber stamp up, and include steel marking hammers, roller stamps, letters, numerals and interchangeable type—hand cut from the best Pittsburgh steel. "Champion" Type Holders are suitable to flat, convex or concave surfaces. Let us tell you about them.

## Jas. H. Matthews & Co.

INCORPORATED

**3946 Forbes Field** **Pittsburgh, Pa.**

***Manufacturers of Marking Devices Since 1850***



# Service is the Test of Forgings

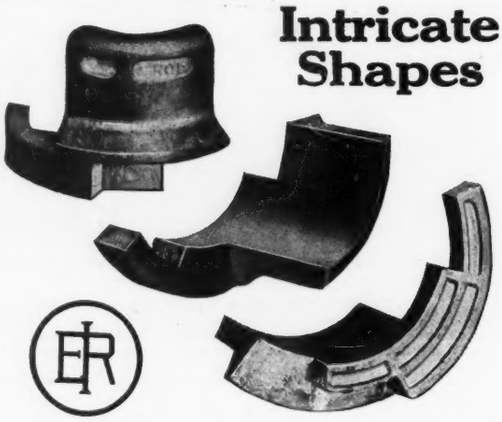
The reputation of the maker is the sign by which to order. DYSON FORGINGS stand the test of long service; they have earned for their makers a reputation for honest work that deserves consideration. Let Dyson estimate on your next forgings. Anything from a 3″ nut to a 5 ton shaft.

***Let us estimate***

## JOSEPH DYSON & SONS

**CLEVELAND** **OHIO, U. S. A.**

# Intricate Shapes



Three views of a die cast packing ring section so designed that three castings make a complete ring. An excellent example of a part which cannot be duplicated in a machined casting.

Ten years' experience making dependable die castings.

Tin, lead, zinc and aluminum alloys.

Send blueprints or samples for estimate.

## ERIE BRONZE COMPANY

**1911 Chestnut St.** **ERIE, PA., U. S. A.**

# JOHNSON

## BRONZE BUSHINGS
### For Every Purpose

Bushings passed by our 100% inspection system are sure to meet with your approval. We are equipped to furnish them in any type from ½" in diameter up to 8" by 8" long. Put your bushing problems in the hands of anti-friction specialists. Your trial order will be convincing. Write Dept. M.

JOHNSON BRONZE COMPANY
BUSHINGS
NEW CASTLE, PA.
NEW YORK PITTSBURGH DETROIT CHICAGO

J. E. DOCKENDORF & CO
20 Broad Sreet New York City.

THE PARKER CO.
165 Broadway
New York City,

## STEEL BEARING BALLS

ACCURACY AND DURABILITY

QUALITY IS UNEXCELLED

*LET US KNOW YOUR REQUIREMENTS*

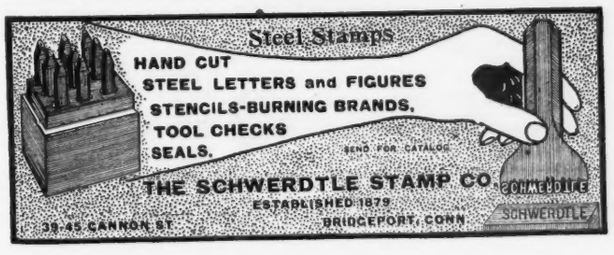
**THE ABBOTT BALL CO.**
ELMWOOD HARTFORD, CONN.

## PEERLESS High Speed Steel

**Also full line of regular Crucible Steels and Steels for special needs**

*Write us for particulars*

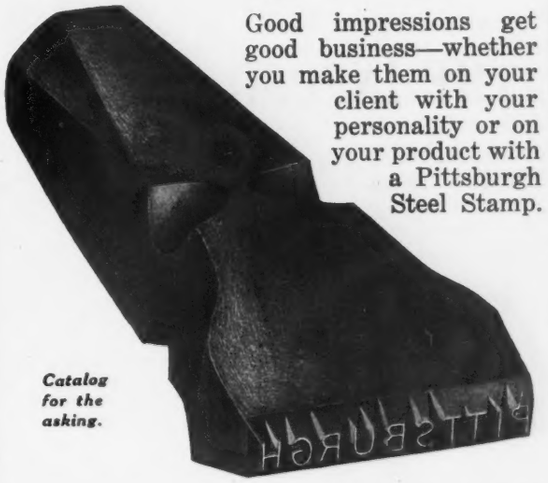
**HELLER BROS. CO., Newark, N. J.**




## Impressions

TRADE MARK PITTSBURGH

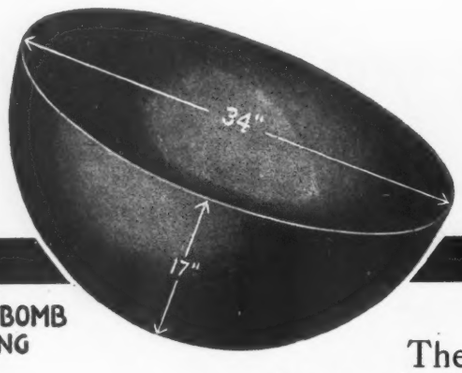
Good impressions get good business—whether you make them on your client with your personality or on your product with a Pittsburgh Steel Stamp.



*Catalog for the asking.*

If you can continue to make good impressions indefinitely, you're on the right road. Pittsburgh Steel Stamps will make good impressions on your product, and keep on making them long after most stamps would have worn out. Your purchasing department ought to know it.

**PITTSBURGH STEEL STAMP CO.**
316 Penn Avenue Pittsburgh, Pa.




DEPTH BOMB CASING

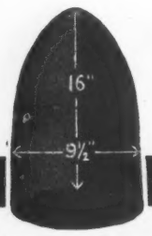
# *Any kind of* STAMPING *from steel*

(HEAVY GAUGES)

The important point for you to remember about us is this:

***We Make Every Kind of Pressed Steel Part from Heavy Gauges to Any Specifications.***

If that's clear, let's have a chance at your requirements—if they are very difficult they will especially please us!




TRENCH MORTAR SHELL CASING

## THE YOUNGSTOWN PRESSED STEEL CO.

YOUNGSTOWN, OHIO

## To Get the Ideal Pinion

The Ideal Pinion is small in size, dependably strong and durable. The one in the photograph is 3¾" dia., 15⅝" long and has 13 teeth. It is capable of sustaining an ultimate load on the tooth of 83,700 lbs. per sq. in.—nearly three times the full load capacity of the press in which it is used. It was heat-treated by

## THE INFUSO PROCESS

The Steel Improvement & Forge Company
CLEVELAND
OHIO

*Write us.*

## The Wear-Ever Adjustable Spacing Collar

A simple device for accurate, speedy adjustment of work on the milling machine. Adjustable in 12 steps of .002" each. 9 sizes ¾" to 1½" bore.

*Send for the Circular*

SCULLY-JONES & CO.

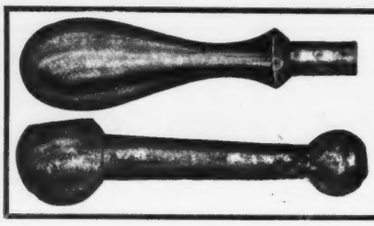
647 Railway Exchange Building
CHICAGO U. S. A.

## HOLLOW BORED FORGINGS AND STEEL SHAFTS

Lathe Spindles, Piston Rods, Cam Shafts, Hydraulic Cylinders, etc.

If you have deep boring work to be done, it can be handled quickly in our shop.

**AMERICAN HOLLOW BORING CO., Erie, Pa.**

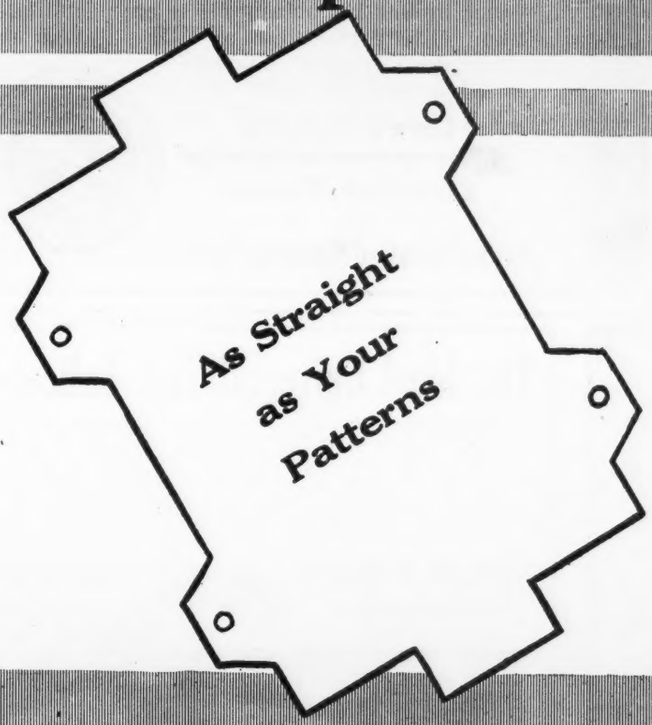


## COMPARE

with your present Handle costs our prices for Ball Cranks and Machine Handles of every description, from bar steel. Accurate, highly finished, complete in every detail and ready to attach.

The Cincinnati Ball Crank Co.
Cincinnati, Ohio
Detroit Office: 1224 Dime Bank Bldg.

# Moltrup Steel Pattern Plates




**All Thicknesses and Shapes**

Moltrup methods give Moltrup Flattened Steel Pattern Plates high finish and close accuracy. You'll find them as straight as your patterns.

We also manufacture Flattened Steel Core Plates, Steel Engraving Plates, Flattened, Ground and Polished Steel Plates and Discs for general machinery construction where a smooth, level plate is required.

**Our process straightens without machining**

Other well-known Moltrup products are: Cold Drawn Steel Shafting and Free Cutting Screw Steel in Rounds, Hexagons, Squares, Flats and Special Shapes; Finished Machine Keys, Finished Machine Racks.

*Let us quote you on your needs.*

**Moltrup Steel Products Co.**
BEAVER FALLS PENNSYLVANIA

AGENCIES: New York Office, Woolworth Bldg. Central Steel and Wire Co., Chicago and Detroit. Union Iron & Steel Co., Cincinnati. Miner-Morse Corp., Erie, Pa. H. D. Cushman Co., Cleveland, Ohio. Milton Pray, Monadnock Bldg., San Francisco, Cal., Alaska Bldg., Seattle, Wash. John W. H. Evans & Co., London, England.

A Mountain of Die Castings made in ten weeks.

Just one order of 200,000 Die Cast pieces turned out by our exclusive automatic "Quality" Die Casting process to meet a customer's urgent needs.

A record performance in time and money saving.

Your next big order should be for "Quality" Die Castings.

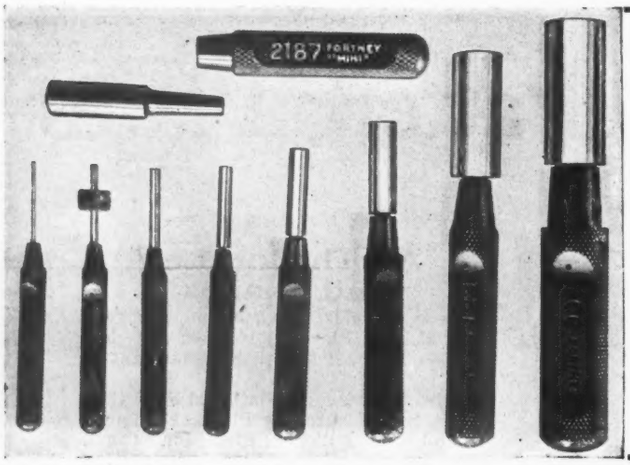
Send for estimates and our interesting book.

**LIGHT MFG. & FOUNDRY CO.**
Pottstown Penna.

# White Metal Die Castings

P

PARKER WHITE METAL & MACHINE COMPANY
ERIE PA., U.S.A




# THESE ARE "MINI" PLUGS

"Mini" plugs are miniature plug gages ranging in size from 0.020" to 1.000". Sizes advance by 0.001"; obtainable in any combination. The correctness of "Mini" plugs is guaranteed within 0.00005" at a temperature of 68° F.

**Here's Where**

**You Get Them**

ALSO

**Fortney Standard Measuring Wires**

FORTNEY MFG. CO. · BELLEVILLE, N.J. ·

# Of What Does This Remind You?

SUPPOSE that you had on hand when your last tap was broken a commercial device built specially to remove the broken pieces of tap, a commercial device not a home-made article, would you not have saved a great deal of time?

*Write Us for Information*

## The Walton Company

310 PEARL STREET HARTFORD, CONN.

# The Ideal Universal Test Indicator

This self-contained little gage is mounted on a hardened steel holder. Readily used on lathe, planer, shaper, miller, boring machine or drill press, attached to a height or surface gage or other convenient place, to test the accuracy of machine, instrument and tool work.

**JOHNSON & MILLER**

42 Murray Street
New York

*Details on request*

Price
$3.00

Pat. App. for

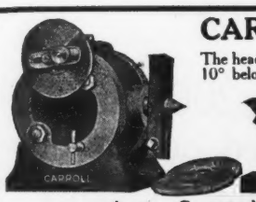
**Pattern Letters and Figures**

Pattern Figures that won't come off. See the points, all one piece. You drive them in.

Made of aluminum, more durable than white metal and cost less.

*Write for Sample*

**THE H. P. MAUGHLIN CO., Columbus, Ohio**



**CARROLL 10½" UNIVERSAL INDEX CENTER**

The head is graduated and may be set at any angle from 10° below horizontal to 10° beyond perpendicular. This rigidly constructed and accurate index center will increase production. Let us tell you how. Write today.

**WM. CARROLL & SON**

Manufacturers

Accuracy Guaranteed

4220 Main Ave. [Norwood] Cincinnati, O.

# Supreme, Lasting Accuracy

**Dickow's 10-Inch Universal Index Centers**

*Patents Pending*

DICKOW

In combination with their great simplicity and ease of operation, helps to increase production. Put us to the test.

**PROMPT DELIVERY**
**For Accuracy Get Dickow's**
*Sold by dealers. Write us today*

**FRED C. DICKOW** 1857 W. Lake Street CHICAGO, ILLINOIS, U. S. A.

# The Laying Out is Hard

Of course *you* know that. And the trouble is, floating buttons and solid test arbors don't help the way they ought.

Why don't you send for that Wablo Ball Pointed Positioning Arbor? Get a money order for $4.00 today and send it to the ***Fisher-Smith Co., Dayton Ohio.***

The Wablo will make a difference on your time slip.

***—And Tell Your Friends***

# SYRACUSE GAUGES

Our standard two pin adjustable snap gauge embodies all the features obtainable in any limit gauge and a few in addition. They make it possible for the unskilled mechanic to work within limits in machining of duplicate parts that would require a tool maker's experience to hold by means of flexible measuring tools. Lightness combined with rigidity prevents the operator from allowing the weight of the gauge to influence the accuracy of the measurement.

***Ask about our adjustable limit length gauge.***

*We will gladly send complete details to all who ask us for them. Look into our four styles of external gauges.*

We are equipped to make special gauges of any description. If our standard models are not adaptable to your work, send us your requirements and we will design a gauge to meet them.

Style D

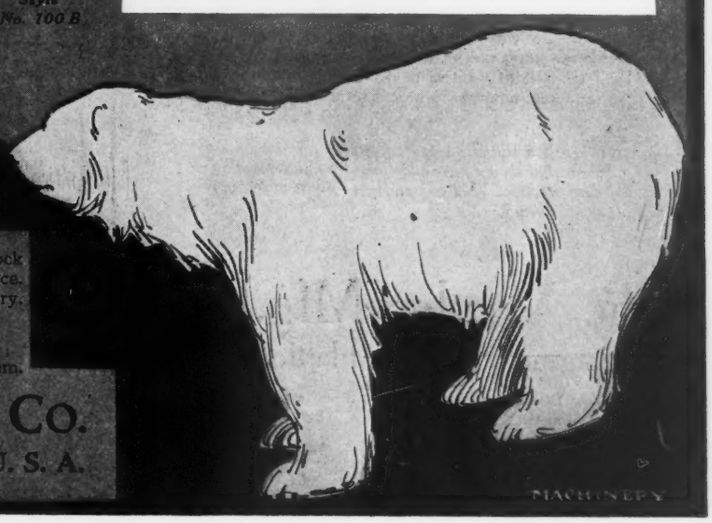
**LOWRY-KNISE TOOL CO., Inc.**

**SYRACUSE, N. Y.**

ALLEN INSTANTANEOUS WATER COOLERS

## Hot Weather Is Now Here

Allen Water Coolers have proven the really economical system to use a lesser amount of ice to help the men "keep cool." A good long drink of clear, cold water just "hits the spot," puts new life into the most disgruntled man and sends him back to work with renewed energy.



Allen Instantaneous Water Coolers are made in stock sizes to hold from 25, 50, 100 and 200 pounds of ice. Lowest cost, the most economical, durable and sanitary.

***Ice in one piece up to capacity.***

Submit your needs and we will quote on sizes to fit them.

**THE ALLEN FILTER CO.**

TOLEDO OHIO, U. S. A.

# The Point Where the "Velvet" Begins

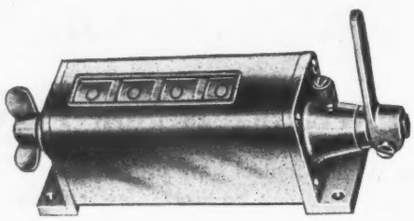
Machines alone can reduce your labor costs up to a certain point, but beyond that point they require **Veeder Counters.**

They require these counters to measure their output and maintain a *standard* marking the limit of their earning power.

Look at it this way:—that every piece produced with the help of

Veeder
COUNTERS

*above* the unaided average, is so much "velvet" with which to maintain profits in the face of high labor-costs.



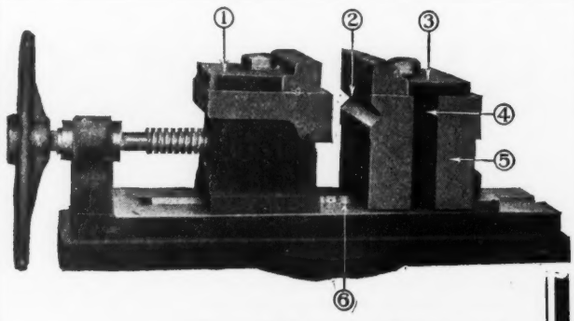
This Set-Back Revolution Counter counts the output of any machine where a shaft revolution registers an operation. Records the number of revolutions, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price, with four figures, as illustrated, $8.50 (List). A similar model to count reciprocating movements of the lever suitable for punch presses, metal-stamping machines and the like, price $10.00. Either model equipped with lock and keys to prevent tampering with the record, $1.50 extra.

*There's a suitable Veeder Counter for every machine that should have one—and for hand-counting purposes, too. Let us send you the booklet that shows them.*

The Veeder Mfg. Co.
39 Sargeant Street, Hartford, Conn.

**Middle West Distributor:**
C. G. Wirick & Co.,
567 W. Randolph St.,
Chicago, Ill.

**Pacific Coast Distributor:**
F. Somers Peterson Co.,
60 Pine Street,
San Francisco, Cal.




**Round, Square, Octagonal Rectangular, Flat, Angular**

and pieces of numerous other shapes are tenaciously held in the sturdy jaws of the

## UTILITY VISE
## —the time-saving device

Put a Utility Vise "on the job"—**use it in the tool room**—it will hold securely a multitude of forms and save the time of the men who draw the highest wages. **Use it as a Universal Jig**—drill or reamer bushings can be readily attached and with length stops at the side, duplicates can be turned out in quantity. Use it in a hundred and more ways—it's always ready for any kind of job anywhere, any time.

**May we send more information?**

**Brown Engineering Company**
133 NORTH THIRD STREET READING, PA.

# Economy is Conservation of Energy

THE MARK OF QUALITY REGISTERED ECONOMY U. S. PAT. OFFICE TO PROTECT THE USER

Conservation of energy is a matter of both personal profit and patriotic duty. Economy is vital to continuous efficient service of every draftsman whether in the largest or smallest drafting rooms.

"Economy" drafting room furniture embodies all the requisites of an ideal drafting table and filing case.

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## QUICK OPERATING LEVER VISE

This Vise is well adapted for use where operation of milling or drilling is short and a large number of pieces are to be handled quickly.

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## TAPS and DIES

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*Special Taps a Specialty*

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CLEVELAND, OHIO, U.S.A.

# Ask Your Foreman

He knows that convenience of operation is a vital factor in realizing efficient production.

Lost motion — wasted effort — laborious methods all drag heavily on the day's output. Working comfort is always essential to efficiency and speed.

## The Wedg-Lok Vise

is an easy answer to many machine shop problems. No matter what the article nor on how many sides it must be worked, it is easily handled in a Wedg-Lok Vise.

Quickly turned to any desired position without removing job from vise. Always accessible from any angle. No need to drop work and retard production.

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Every part of the Wedg-Lok Vise is machined to close measurements. Will handle the most intricate of jobs with absolute accuracy. Impossible to vibrate or work loose.

A slight turn of handle tightens the jaws and securely locks vise in base. A turn of the thumb screw locks it for permanent use in one position.

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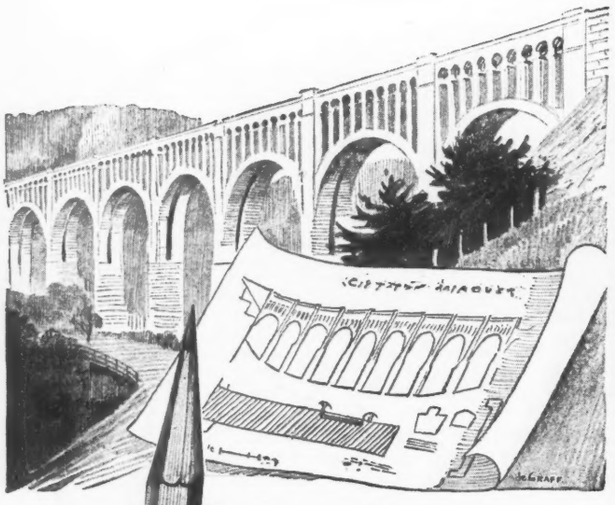

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Buying Shop Furniture is like choosing tools. Durability and economy are figured together.

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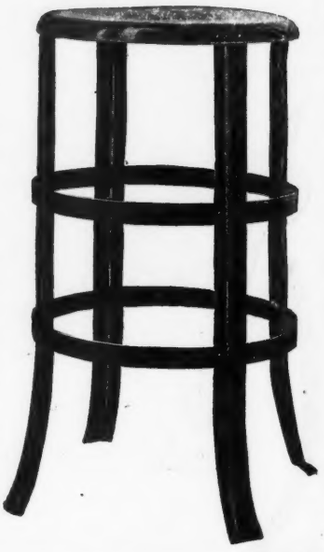

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Incorporated when assembling or easily attached to machines already on the floor.

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All styles, to meet every man's choice.
All prices, that every toolmaker may own one.
Cases leather covered.

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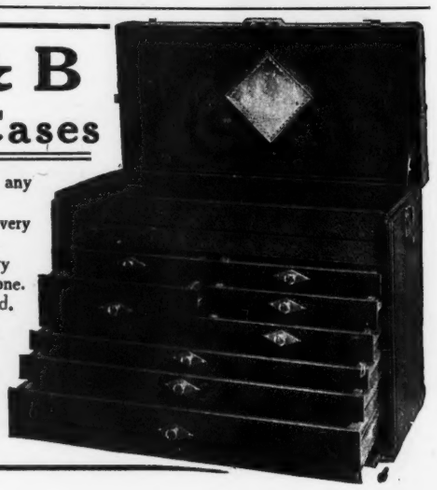

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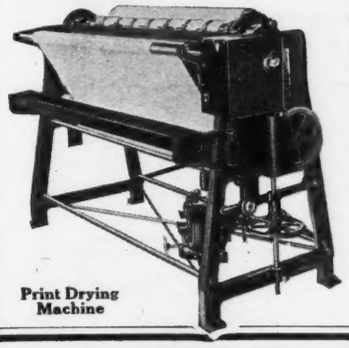
# PARAGON BLUE PRINT MACHINE



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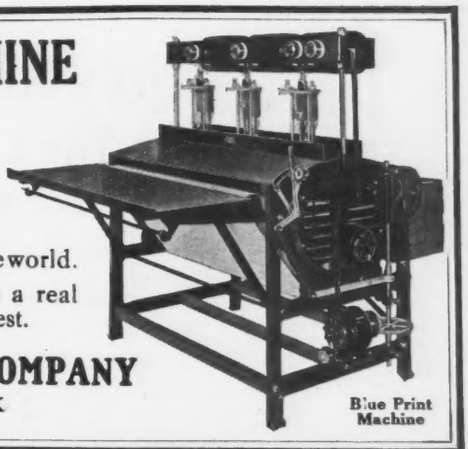
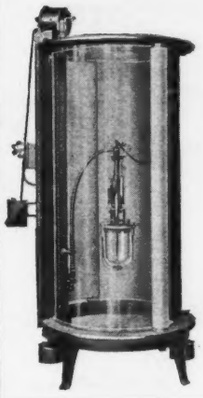


Blue Print Machine



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**IT'S THE SPACE THEY SAVE THAT MAKES THEM POPULAR**

A strong, sturdy sectional rack—100% efficient. Ask us.

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have been sold continuously since 1904 and have stood the test of time. Hundreds of satisfied users have proven that enthusiasm for the Wagenhorst Blue Printer increases in proportion as familiarity with its dependable performance grows.

Our Vertical Automatic Printer suitable for moderate capacity is the lowest priced of the standard machines. Our Flat Glass Continuous model will equal any machine in the market for capacity and both types have advantages in operation and design which will appeal to the discriminating buyer. Full information and descriptive literature on request.

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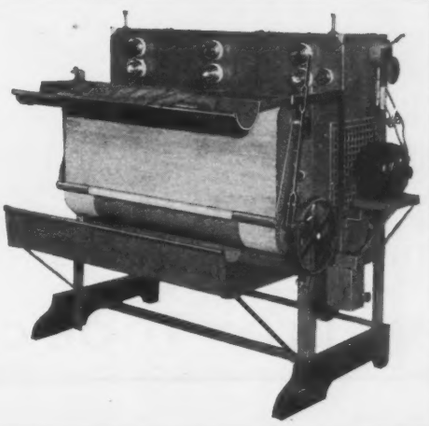

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*The Cutter Specialists of Connecticut*

**50 REMER STREET BRIDGEPORT, CONN.**

***Ask us about our process of manufacture as an element in cost.***

During the war our tools contributed to the manufacture of thousands of machine guns. They are now helping to build tractors and steamships.

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## Lathe Tool Holder

**Four Tools In One**

Great time saver on work having 2 to 4 operations.

Ask to see the Windau Tool Holder at your dealers or write us direct.

A miniature turret head carries four tools. Locked, unlocked and indexed with the wrench, the action is simple, accurate and positive—operation easy and convenient; the time saving possibilities are remarkable.

Size shank 1¼"x⅝". takes ⅜" square bits.

**List price $15.00**

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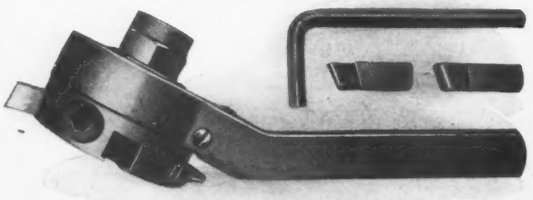

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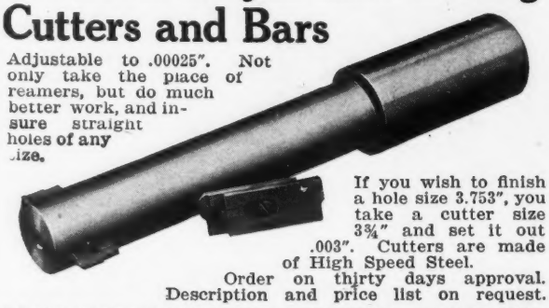
Adjustable to .00025". Not only take the place of reamers, but do much better work, and insure straight holes of any size.



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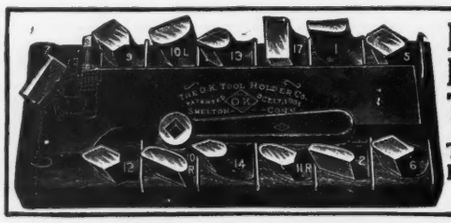

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# 31,000 Taper Holes

Reamed with one reamer at an average grind of every 1000 pieces

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Engineers use VENUS Pencils in their offices and drafting rooms because the *exact* uniformity of each of their 17 degrees reduces errors to a minimum. Quicker, easier, better work is done with them, by executives and working staff alike.

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Send 14 cents for 3 trial samples, mentioning degrees. After you find how perfect VENUS Pencils are, buy them at any dealer.

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# Grover Handles

Simple
Efficient
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Will not split when tang of file is "driven home." Filler is of best white birch—ferrule is of pressed steel and can be used with other fillers when latter becomes worn. Used by leading manufacturers and railroads. Write for details.

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are extremely sensitive.

No leveling is required.

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Manufactured by

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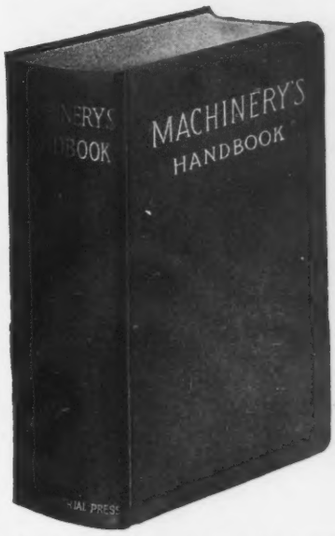
# MACHINERY'S HANDBOOK

**The Standard Mechanical Reference Book for Machine Shop and Drafting Room**




Over 100,000 men engaged in designing, constructing and operating machinery find in this compact 1400 page handbook all the essential practical data required to cover adequately the whole range of machine shop practice and machine design.

Tables covering the entire field of drafting room and machine shop practice will be found logically arranged in this convenient handbook. Many of the tables are original with this work and prepared especially for it. The practical data are the most complete and dependable ever prepared for the use of draftsmen, machinists, foremen, superintendents, works managers and mechanical executives.

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The Tool Holder Principle with which the name ARMSTRONG has been identified for 25 years has never failed to make good under the hardest working conditions. Other types have met with a certain measure of success on light work but usually their manufacturers are, in the end, forced to swallow the Armstrong principle, set screw and all.

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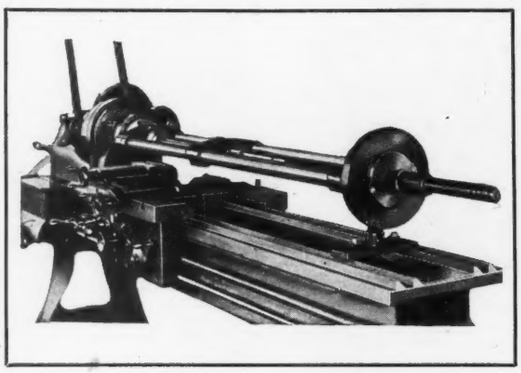
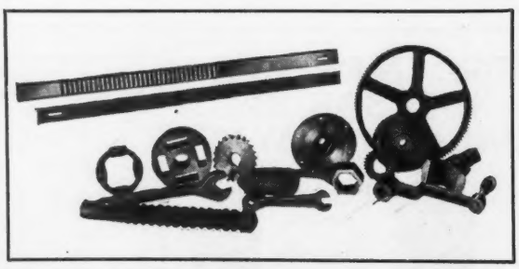
## Lathe Broaching Attachment



## A Fully Equipped Machine at Low Cost

The Velco Lathe Broaching Attachment overcomes what may be said to be the greatest objection to a special broaching machine—its price. It is, however, just as efficient. Attach it to your lathe, and you at once have a first class broaching equipment, with a capacity of 1½″ on square hole, and ½″ on keyway. Stroke is 48″, and it can be adjusted to any lathe from 12″ to 18″. Get the facts.



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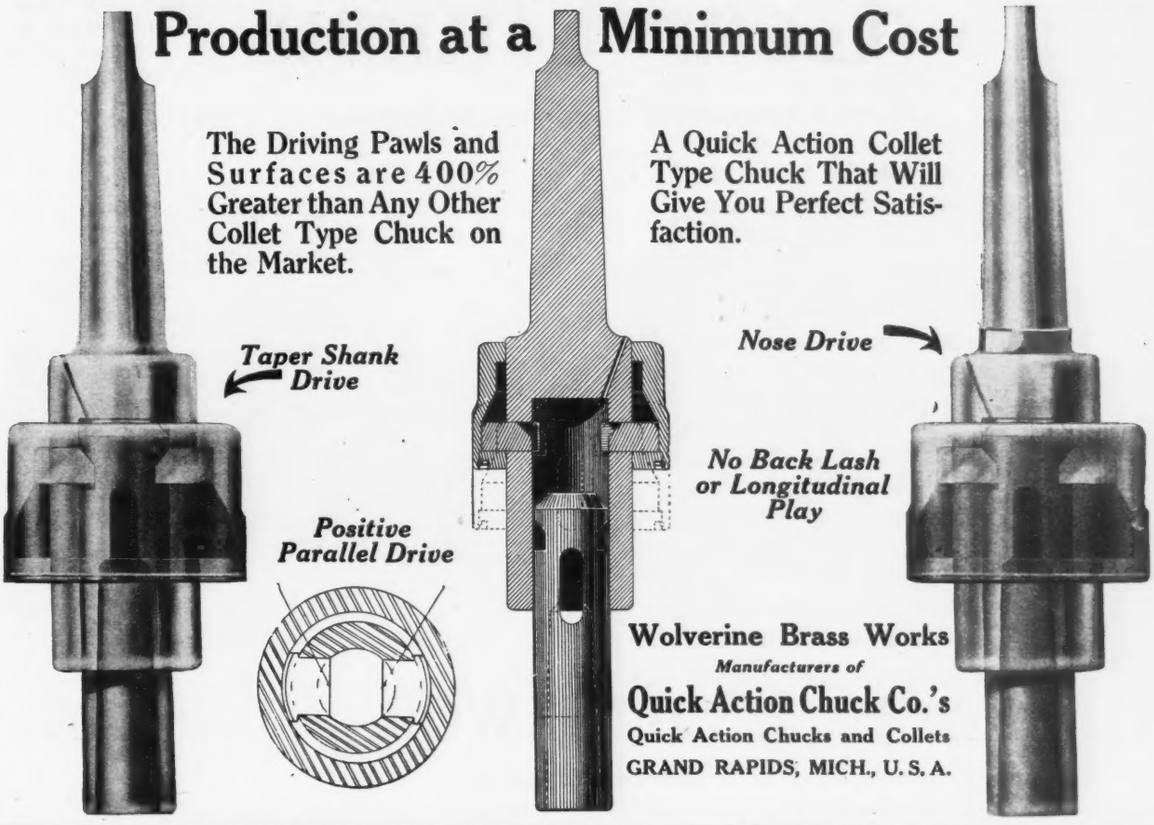


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*Manufacturers of*
**Quick Action Chuck Co.'s**
Quick Action Chucks and Collets
GRAND RAPIDS, MICH., U. S. A.

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***Four "Reasons Why"***

Accurately ground, heat-treated holders; carefully tempered high speed steel cutters; pack hardened pilot bushings driven by the cutter teeth instead of a set screw; pilot pins which merely lock the tool together and do not take the strain of the work. One of the most dependable and economical tools of its class.

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Attaches to any upright drill press and converts it into a first-class milling machine that will perform 90 per cent of the lighter milling operations in any shops just as well and a whole lot cheaper than an expensive miller. An accurate, well built device that will earn its cost in quick time. Let us send the descriptive circular—it shows some of the operations this tool performs.

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*They are Fool- and Dust-proof and Safe in the Hands of the Inexperienced Operator.*

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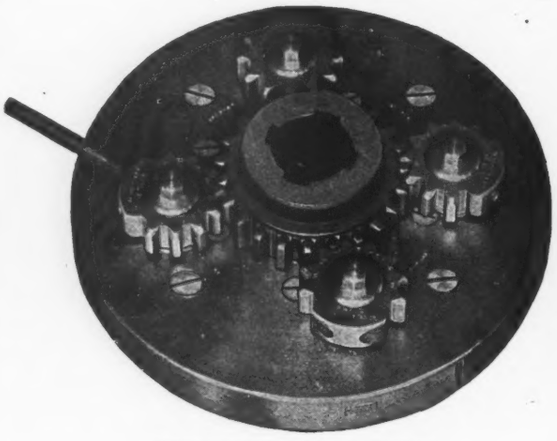
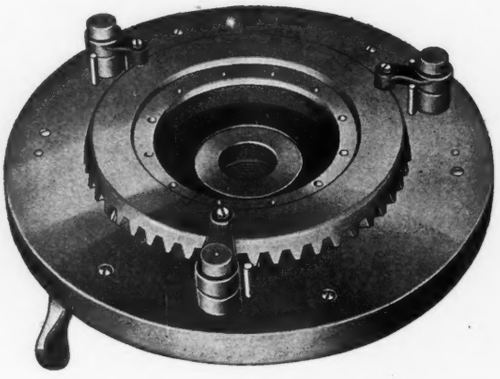
*They are for Manufacturers Who Demand that Holes in Gears be Ground Concentric with the Pitch Diameter.*

***Chucking Time, 4 to 6 Seconds***



JOHNSON GEAR CHUCKS
**For Spur, Spiral or Internal Gears**



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**For Spur, Helical or Skew Bevel Gears**

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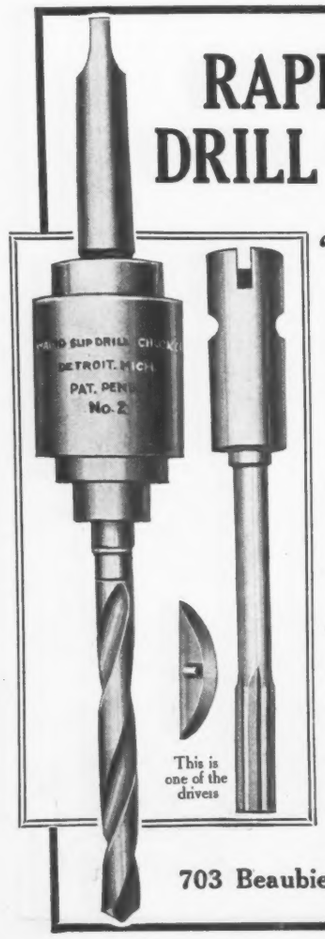


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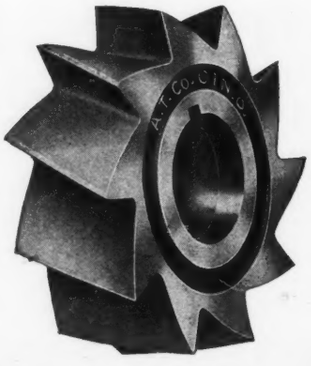

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Put a set of "NICHOLSONS" to work now. Increase your production and decrease lost motion.

*Write us today and we'll send you a set to test in your factory under your conditions*

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DON'T buy simply an elevating truck.
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**Three and Four Flute**
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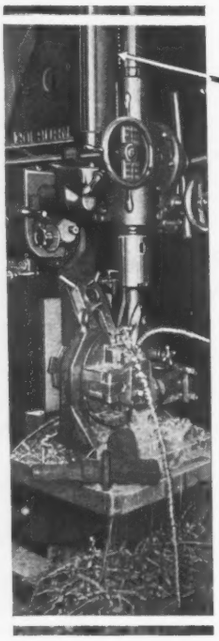

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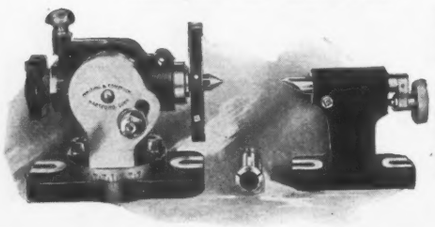

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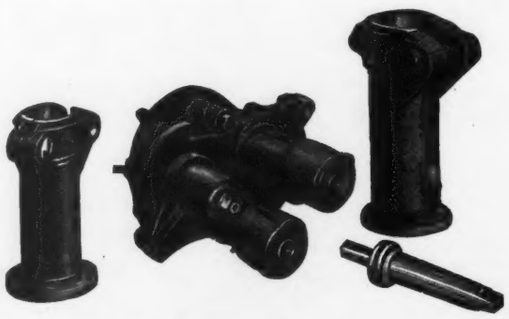
**WHITING & COMSTOCK**
HARTFORD, CONN.



No. 2—2 Spindle Adjustable *Buhr* Patent Ball Bearing Drill Head

## The Buhr DRILL HEAD

Adjustable Ball Bearing Drill Heads From 2 to 12 Spindles Fixed Center Any Number of Spindles

**NELSON-BLANCK MFG. CO.**

DETROIT MICHIGAN

## A GERSTNER TOOL CASE

commends the respect of the shop. Good looking, practical and economical, it protects tools from accident, dampness and loss.

Many sizes and prices to suit all needs.

*Write for our Catalogue*

A. Gerstner & Sons, 61-71 Columbia St., DAYTON, OHIO, U. S. A.

# Stainless Steel for Gages, Micrometers and Fine Tools

Stainless Steel is just what its name indicates. It does not rust; it has great strength; it resists erosion. These qualities make it an ideal steel for the manufacture of fine tools of all kinds, for use in races and rollers for bearings, printing blocks, automobile springs, water meters, steam traps and for various other machine and mechanical parts.

***Stainless Steel may be drawn into wire, rolled into sheets or made into weldless drawn tubes. Let us tell you more about it.***

## AMERICAN STAINLESS STEEL COMPANY

1541 Oliver Building PITTSBURGH, PA., U. S. A.

## Extend Your Consideration of Quality to the Little Things

# BUY PANNIER STEEL STAMPS

Every step in the manufacture of Pannier Steel Stamps, from cutting up the stock, as shown in this photograph, to shipping finished product, is under careful supervision. The result is a stamp of the better kind.

The Pannier Bevel eliminates sharp corners where splitting ordinarily starts. Strains are evenly distributed, and the life of the stamp is thus materially prolonged.

***Let us have your orders***

We feature our quick service on orders for single letters and figures. We have an unusually good stock on hand at all times and invariably fill orders the day they are received.

## PANNIER BROS. STAMP COMPANY, Inc., Pittsburgh, Pa.

# How Much Metal in a Forging?

*Let us estimate*

**The Johnston & Jennings Company**

Addison Road and
Lake Shore
R. R. Tracks

CLEVELAND
OHIO

If it's a Johnston & Jennings forging, there's very little more than is needed. You don't have to pay for excessive waste stock and the cost of removing it.

Johnston & Jennings forgings are made with the utmost care throughout, including this special consideration of economy in the customer's interests. Note the collars on the screw machine spindles in the accompanying photograph.

## Down Goes the Cost of Production

A FILE which makes it possible to produce ten pieces where only nine were produced before, distributes labor and overhead costs over the larger number of pieces. Thus it reduces these important items to the extent of 10 per cent per piece produced.

Vixen files cut three to five times faster than ordinary types. Think what this means, and you will understand why they are the most economical although the highest priced.

**Write for full particulars**

**VIXEN TOOL COMPANY**
NEWARK NEW JERSEY

VIXEN CURVED TOOTH FILES

# JUST ARRIVED!

THE latest development in self-opening die heads is now ready—the Victor, made by the makers of Victor Collapsible Taps. Distinguished by the same high class workmanship and efficient operation. The Victor Die Head, might, in fact, be described as the Victor Tap turned inside out.

Individual plungers set at an angle of 14.5° support the chasers at a corresponding angle. Slots in the latter fit into a tongue milled in the former. Plungers are securely held in a collar which insures simultaneous action in opening or closing head. Bearing is given chasers along their entire length—*they cannot tilt and cut tapered threads.*

Victor Die Heads open automatically as soon as travel of turret is stopped. They can be adjusted to cut 1/32" over or undersize. Roughing and finishing attachments are standard equipment. If desired "Victors" can be supplied with a hollow shank so that any length thread may be cut. Head being completely enclosed, neither chips, dirt or foreign matter can enter.

***Explanatory booklet on the Victor Die Head is ready. Send for your copy today.***

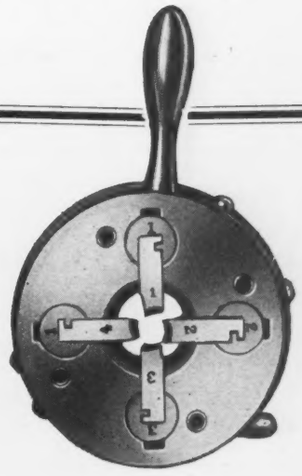
## Victor Tool Company

**Waynesboro, Pa.**

# THE VICTOR

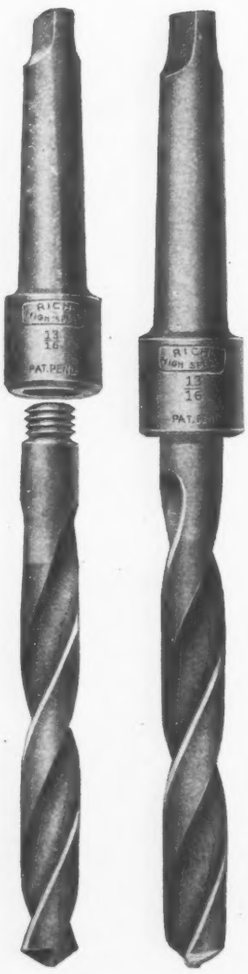
## Self-Opening and Adjustable

# DIE HEAD



# DRILL SALVAGE

## As First Aid to Rising Shop Costs



List No. 22
TWO-PIECE
INTERCHANGEABLE

A message to the man responsible for costs and production.

The mortality of shop tools is a subject to which you have given much thought. Drills and reamers will wear and break and accidents will happen. Perfectly good drills will break off at the shank or a perfectly good shank must be discarded when the drill is damaged or worn out.

It is to meet these ever-present conditions that we have designed the RICH No. 22 Two-Piece Interchangeable Drill which makes it possible to conveniently and economically reclaim your broken shank drills and thus place your shop costs on a lower level.

The blade of the RICH No. 22 in common with all RICH products, is forged from the bar at the proper temperature and is fitted with a straight thread and a taper which engage a similar thread and taper in the shank. The thread does not seat. The taper takes the thrust. This shank can be furnished standard or oversize, making it possible to use drills to which you can adapt either standard or oversize shanks as desired.

Positive alignment is assured. If the blade wears out or is accidently broken, you do not have to buy a whole tool. The blades or shanks may be obtained separately. Your broken shank drills can be fitted to these sockets.

The RICH line consists of Taper and Straight Shank Drills and Reamers; Track and Bonding Bits, Countersinks and Rivet Sets in a wide range of sizes and styles, and as they are built to give maximum and uniform results, they are adopted as STANDARDS in shop equipment of their character.

Complete literature on the subject is yours for the asking. Send for it.

## RICH TOOL COMPANY

**RAILWAY EXCHANGE**

**CHICAGO**

**NEW YORK** **DETROIT** **NEW ORLEANS** **SAN FRANCISCO** **SEATTLE**
**PHILADELPHIA** **MILWAUKEE** **KANSAS CITY** **PORTLAND** **MONTREAL**
**ST. LOUIS** **CLEVELAND** **PITTSBURGH**

# THISTLE BRAND TAPS

## Are Used Exclusively in the Manufacture of

# YALE TIME LOCKS

Half a century of lock making is behind the Yale product of today. The experience of half a century dictates the choice of materials, machines and methods in the Yale & Towne plant.

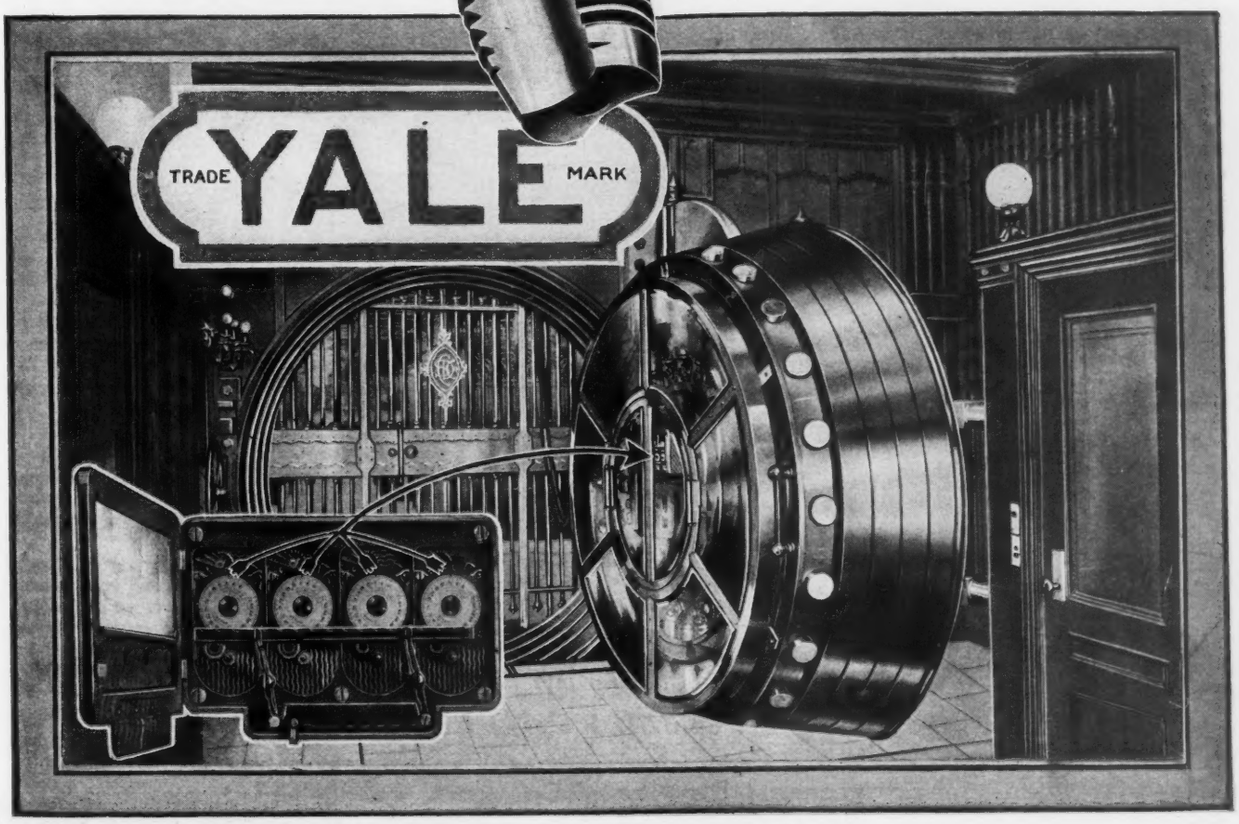
We state these facts to emphasize the important (to us) fact that the Yale & Towne people have selected Thistle Brand Taps and use them *exclusively* on such important and delicate mechanisms as the Four Movement Time Lock shown below. There's a moral to this story. We invite you to apply it to your own ends.

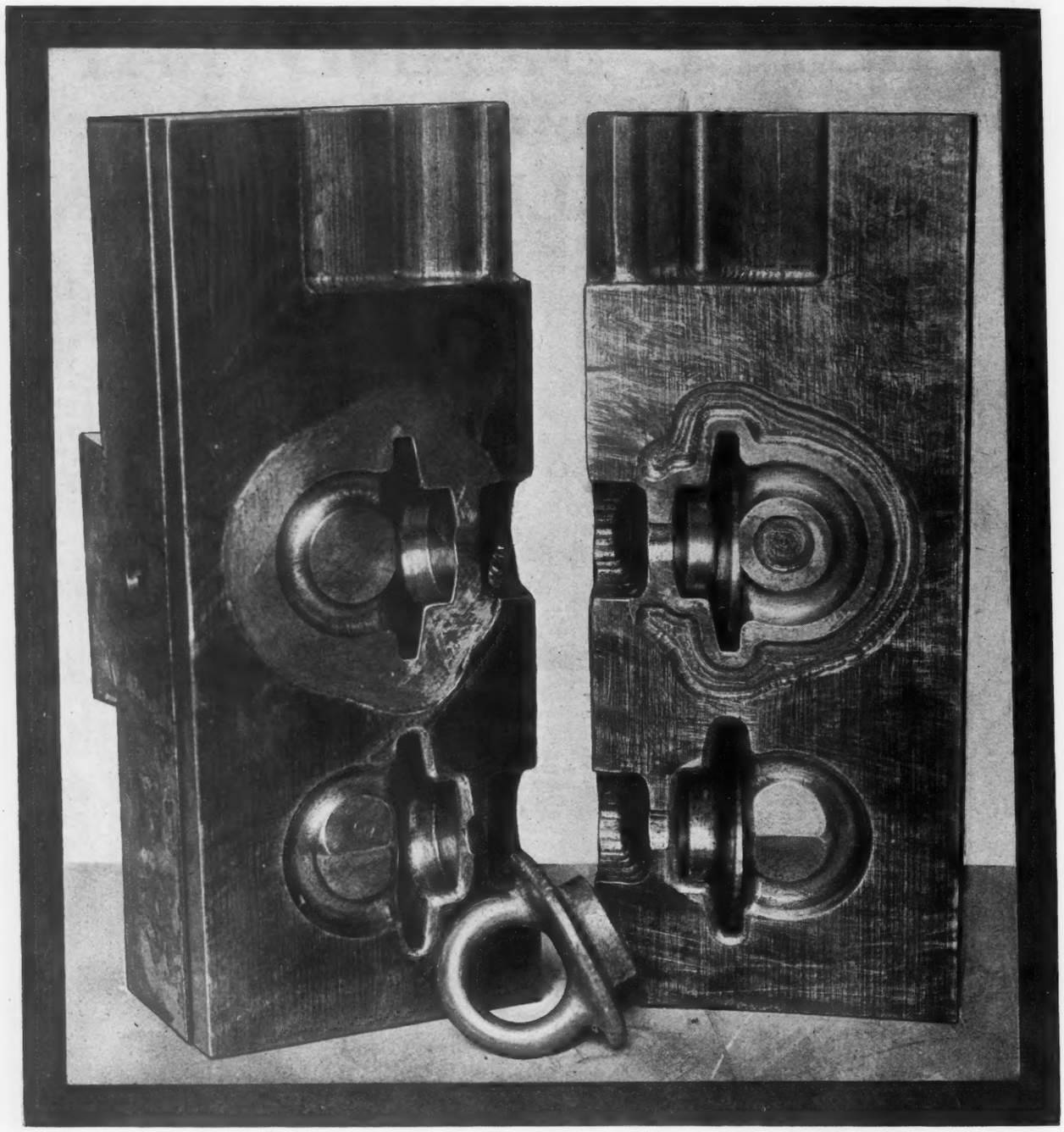
***Let us tell you all about Thistle Brand Taps***

**WINTER BROS. CO.**

**Wrentham Mass., U. S. A.**

Detroit Office, 1404-5 Real Estate Exchange Bldg.
Buffalo Office, 76 Pearl St.
Chicago Office, 106 South Jefferson St.

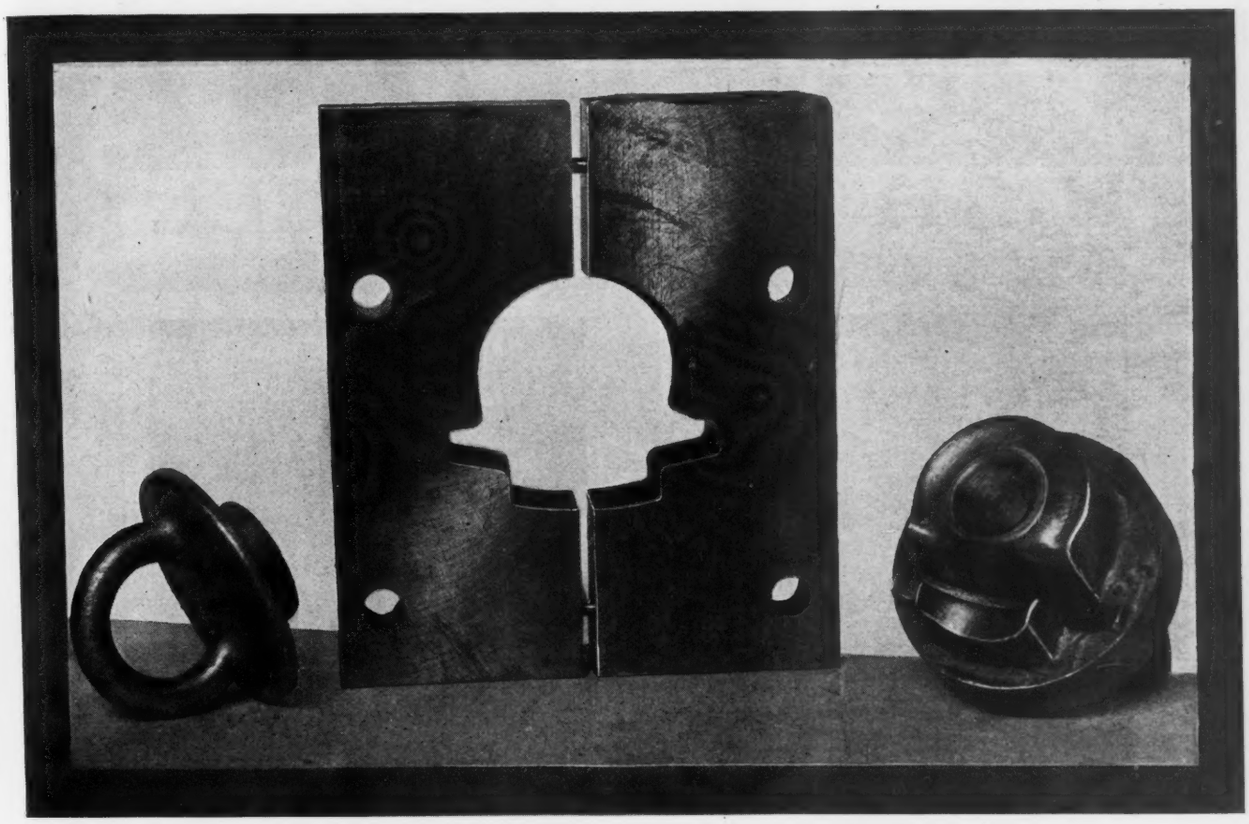




W.F.M. Co.

# Accurate, Durable, Intricate Drop Forge Dies are made in the Meyers Shops

*Accompanying illustrations show good examples of this class of work.*



# What's the Matter With Your Drop Forge Dies?

The unretouched photographs from which these reproductions were made show Meyers Drop Forge Dies just as they looked when on the job. These are good examples of high class dies such as we are making in wide variety for the Navy Department, the automotive industries and other large industrial concerns.

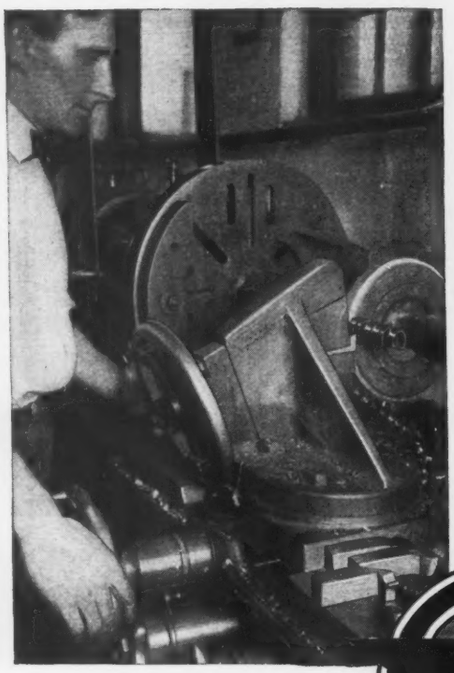
No matter how intricate your dies may be or how close the size limits or what troubles you may have run up against in the actual use of drop forge dies, we have a fully equipped and entirely capable organization ready and willing to make dies for you that we'll guarantee to give entire satisfaction.

Have Meyers make them and your drop forge dies will be right, they'll wear well and they'll earn their cost. What more can you ask?

## W. F. MEYERS GAGE COMPANY

**BEDFORD** **IND., U. S. A.**

# Colonial
## HIGH SPEED STEEL



TRADE MARK REGISTERED

TURNING rough castings? So is this shop—with Colonial High Speed Steel for tools. They're turning crankshafts for automatic stokers—rough, scaly, cast steel stock that takes the life out of tools—and 5½ per day, one machine, *was* the limit. Since they put Colonial High Speed Steel Tools to work, production has been boosted almost 100 per cent—a finished crankshaft in 35 minutes—about ten a day—is the present rate. Photographs show one of the roughing cuts on the diameter—½" is removed in one cut. Both bearings are roughed and finished to gage size, flange must be finished on both sides and edge. Give Colonial High Speed Steel Tools the "comparative test"—it's the test that tells the tale.

## COLONIAL STEEL COMPANY

Pittsburgh New York Detroit Boston St. Louis Chicago

# MACHINERY'S
# GREEN SECTION

**Here in this Green Place buyer and seller of used shop equipment meet and do business. Here is the livest mart to be found anywhere—the greatest number of buyers, all the big sellers, the widest range and variety of tools and accessories. It is the place of big business in used equipment. Use it both ways—to buy and sell.**

*The GREEN SECTION is MACHINERY'S Department for Used Shop Equipment.*

## MACHINERY

**140-148 Lafayette Street, New York City**

# USED MACHINE TOOLS

**These machines have been carefully inspected and overhauled if found necessary**

No. 2 Rochester table type, belt driven horizontal boring machine.
No. 1 Lucas horizontal boring and milling machine.
No. D1 Colburn heavy duty drills (9).
28″ Snyder sliding head drill with belted power feed.
37″ Gould & Eberhardt sliding head drills, B.G., P.F., tapping att., compound table (3).
24″ Mechanics sliding head drill, B.G., P.F.
26″ Barnes sliding head drills, B.G., P.F. (4).
No. ½—1 sp. Avey column type drills (5).
No. ½—1 sp. Avey bench type drills (24).
4 sp. Henry & Wright BB. drill, pump and piping.
7 sp. Henry & Wright BB. drill, pump and connections.
4′ Bickford plain radial drill, gear box and tapping att.
5′ Dreses plain radial drill, cone drive, B.G., tapping att.
6 sp. Hendey drill with P.F. to each spindle.
No. 11 Landis plain grinder.
No. 4—12 x 60 Landis universal grinder.
10 x 48 P. & W. plain grinder.
10 x 36 Norton plain grinders (3).
10 x 50 Norton plain grinder arranged for motor drive.
No. 2 B. & S. universal grinder.
No. 2 Oakley univ. cutter and tool grinder.
No. 70 Heald internal grinder.
No. 75 Heald internal grinder.
No. 34 VanNorman internal grinders with water att.
Garrigus rotary surface grinders (16).
No. 1 Hartford auto. surface grinder.
12 x 36 Cincinnati plain grinder.
No. 1 Norton cutter and tool grinder (2).
No. 2 Whiton spur gear cutter.
No. 4 B. & S. auto. gear cutter.
No. 3A Cincinnati auto. spur gear cutter.
250 lb. Bell steam hammer.
9 x 12 Porter-Cable lathe, taper and facing att.
14 x 6 Prentice Bros. lathe with chuck.
18 x 8 Perkins lathe.
16 x 6 Hendey geared head lathe, C.R., P.C.F., S.R., hollow spindle.
20 x 12 Lodge & Shipley patent head lathe.
20 x 8 Shellenbach lathe, D.B.G., quick change gear mechanism.
24 x 12 Niles lathe, C.R., P.C.F.
26 x 12 Putnam lathe, C.R., D.B.G. (2).
No. 3 Fox plain miller, No. 1 arbor.
No. 14-A Garvin plain miller (7).
No. 14 Garvin plain miller (4).
No. 15 Garvin plain miller.
No. 1 Dow plain miller, B.G.
No. 2 Cinn. vertical cone drive miller.
No. 1½ Cincinnati plain millers, complete with new vises (4).
No. 2 Kempsmith univ. miller, complete.
No. 1 Kempsmith plain miller, complete.
No. 1 Steptoe plain millers, complete with vises (2).
No. 1½ B. & S. plain miller, complete with new Cinn. vise.
No. 2 Owen plain miller, complete with new Cinn. vise.
No. 0 Steptoe plain miller, complete with vise.
24 x 24 x 6 Putnam planer.
24 x 24 x 6 Flather planer.
24″ Juengst crank shaper.
20″ Hendey shaper.
No. 1 P. & W. wire feed screw machine (2).
24″ Gisholt turret lathe, 6¼″ hole.
4¼″ Cleveland auto. screw machine (2).
2″ Cleveland auto. screw machine (6).
Fay auto. lathe.
8 x 8 Clayton single air compressor, belt drive.
No. 4 Lapointe broaching machines (2).
8 cu. ft. oil separator, steam turbine drive.
No. 67 Stoll press, complete.
Blanchard belt driven high power vertical surface grinder.
No. 38 American oven furnaces (2).
42 x 30 x 10 Powell planer, 2 heads, T. & L. pulley c/s.

## HENRY PRENTISS & COMPANY

INCORPORATED

**149 BROADWAY, NEW YORK**

BOSTON BUFFALO ROCHESTER SYRACUSE

Warehouse: JERSEY CITY

# Re MANUFACTURED -(ORIGINATED BY US)- MACHINE TOOLS

## ONLY THE VERY LATEST MODELS

We are buying only the latest model machines in good condition, and only such as can be bought to *sell* at *real bargain prices.*

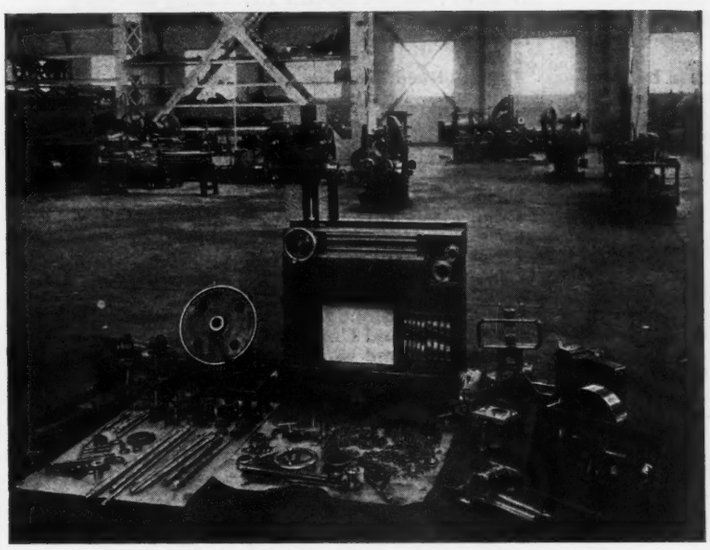
**EACH RE-MANUFACTURED MACHINE**

1. Completely disassembled.
2. Flat surfaces hand scraped to B. & S. Surface Plates.
3. Bearing realigned.
4. Exterior refinished.
5. Adjustments made.
6. Tested under belt for operation and accuracy.

And we are filling our warehouse full to the roof with just such tools. We can secure these machines at bargain prices, where you or other dealers cannot, because we have the cash to buy outright, and the space to store complete equipments, regardless of how large.

These tools are then re-manufactured in our own plant, so that in many respects they are even better than new.

**Our re-manufactured tools are so good and the price so low that you cannot afford to buy a new tool when a re-manufactured one is available.**



**LATHES (450)**

18 x 8 LeBlonds.
18 x 8 Americans.
19 x 8 LeBlonds.
20 x 8 Americans.
20 x 8 LeBlonds.
21 x 8 LeBlonds.
26 x 10 LeBlonds.
26 x 10 Americans.
26 x 10 Bridgefords.
26 x 12 Bridgefords.
32 x 12 Pittsburghs.
34 x 11 Americans, Gd. Hd.
34 x 20 Americans, Gd. Hd.
40 x 12 Fifields, Triple Gd.
40 x 18 Fifields, Triple Gd.
40 x 24 Fifields, Triple Gd.

**RADIAL DRILLS**

1—3' American Sensitive.
1—5' Universal.
1—5' Putnam.
1—5½' Baush.

**BORING MACHINES**

2½" Bar Cleveland.
1—Beaman & Smith Horizontal Cylinder Boring and Milling.
1—6" Bar Sellers Cylinder Boring and Facing Machine.

**PLANERS**

1—24" x 24" x 6' Hamilton.
1—24" x 24" x 6' American.
1—36" x 36" x 10' Whitcomb, 2 hds.
1—36" x 36" x 10' Cincinnati, 2 hds.
1—36" x 36" x 13' Sellers Spiral, 2 hds.
1—48" x 48" x 18' Sellers Spiral, 1 hd.
1—50" x 30" x 8' Gray.
1—60" x 38" x 10' Gray.
1—76" x 48" x 18' Woodward & Powell, 2 hds.

**MILLING MACHINES**

1—No. 9 Kempsmith Plain.
1—No. 24 Brown & Sharpe.
1—No. 2 Becker-Brainard Plain.
1—No. 3 Brown & Sharpe Vertical.
1—No. 5 Becker-Brainard Plain.

**GRINDERS**

3—12" x 24" Modern Plain.
2—12" x 36" Landis Plain.
1—12" x 42" Cincinnati.
1—No. 70 Heald Internal.
1—No. 1½ Bath.
1—No. 22 Brown & Sharpe Internal.
1—Thompson 8" x 48" Surface.

**TURRET AND SCREW MACHINES**

1—12" Foster-Kimball.
2—16" Pratt & Whitney.
1—24" Warner & Swasey Chucking.
1—24" Foster Turret.
3—24" Steinle.
14—No. 3-A Warner & Swaseys.

**PRESSES, ETC.**

1—36" Wide Power Corrugating Roll.
1—96" Robinson Power Brake.
1—No. 2 Bethlehem Power Slitting Shear.

**MISCELLANEOUS**

1—7½" Nutter-Barnes Cold Saw.
1—No. 525 Newton Steel Fdry. Cold Saw.
2—2 Spindle Pratt & Whitney Profilers.

**OUR GUARANTEE:** YOUR MONEY BACK IF YOU RETURN MACHINE WITHIN 30 DAYS OF DATE OF SHIPMENT—FREIGHT PREPAID NO EXCUSES NECESSARY!

# HILL, CLARKE & CO. OF CHICAGO

649 Washington Blvd., Chicago, Ill.

# MACHINE TOOLS

## For Sale By

*Ford Motor Company*

DETROIT, MICHIGAN

These machines were purchased for the Liberty Motor Division,—some of them are new,—all are in excellent condition. The machines are offered subject to prior sale, F. O. B. Detroit. "As Is Where Is." Inspection can be made at Highland Park Plant of Ford Motor Company.

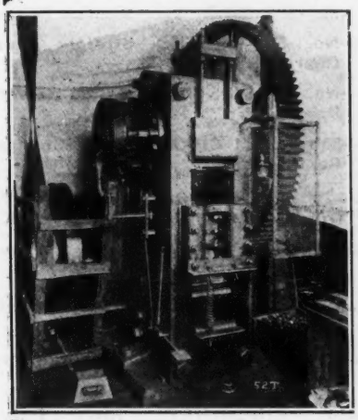
10 No. 2 Cleveland Plain Milling Machines.
1 6x6 Richmond Air Compressor.
3 No. 1 Standard Hand Milling Machine.
1 C-3-T Grand Rapids Drill Grinder.
1 Walker Special Miller.
1 U. S. Hand Miller.
1 No. 32 Demco High Speed Sensitive Drill.
4 No. 1 Kempsmith Mfg. Co. Plain Miller.
4 18x8 Boye & Emmes.
10 24x12 Lodge & Shipley Crankshaft Lathe.
3 No. 3 Defiance 24" H. D. Drilling Machine.
3 Bx 12" Sipp Drill.
1 Bx 1" Sipp Drill.
2 CG Sipp Drill, Universal Table.
3 Type B Briggs Milling Machine.
6 No. 12 2 spindle Leland & Gifford Profiling Machine.
3 No. 20 Ohio Universal Milling Machine.
2 24" Ohio Plain Milling Machine.
1 28" Ohio Universal Milling Machine.
1 3-C Lees Bradner Thread Miller.
2 D-2 Minster H. D. Drilling Machine.
3 Taft Pierce Archdale Thread Milling Mach.
3 No. 10 A. Bryant Semi-Auto H. & F. Grinder.
3 No. 10 A. Bryant Semi-Auto H. & F. Grinder.
65 No. 20 A. Bryant Deep H. & F. Grinder.
16 No. 1½ Duplex Garvin Milling Machine.
15 No. 2 " " " "
5 No. 13 Plain " " "
1 No. 17 Foote-Burt 7 spindle Drill.
29 No. 25 24" Foote-Burt H. D. Drill.
28 No. 25 Becker Plain Miller.
3 ACS Double Spindle Vertical Drill'g Mach.
4 Becker Heavy Type Hand Millers.
4 No. 3 H Becker Single Spindle Profiler.
1 No. 3 Becker Vertical Milling Machine.
2 No. 3 Becker Vertical Milling Machine.
1 No. 3 Diamond Auto Surface Grinder.
1 No. 2 " " " "
3 Small " " " "
4 2 spindle Diamond Gun Barrel Drill.
1 18x96 Norton Tool Room Grinder.
47 Reed Prentice Double Bar Boring Machine.
1 1xH Reed Prentice Back Arm Prod. Lathe.
13 2xH " " " " " "
2 3xH " " " " " "
1 16x10 Reed Prentice Eng. Lathe.
1 20x10 " " " "
3 20x12 " " " "
1 No. 70 Heald Power Feed Internal Grinder.
16 No. 60 Heald Cylinder Grinder.
13 No. 75 Heald Hand Feed Internal Grinder.
3 No. 1-B Milwaukee Plain Miller.
1 No. 1½-B Milwaukee Vertical Miller.
10 No. 2-B Milwaukee Plain Miller.
1 No. 2½-B Milwaukee Vertical Miller.
2 No. 3 Baush High Speed Multiple Drill.
2 28" Ohio Plain Miller.
6 21 26x12 LeBlond Universal H. D. c/s Lathe.
6 17x12 LeBlond Universal Turret Lathes.
1 17x14 LeBlond Universal Turret Lathe.
19 21x12 LeBlond H. D. Auto Lathes.
2 No. O-B LeBlond H. D. Plain Milling Mach.
15 2¼x26 Acme Comb'n Flat Turret Lathes.
4 No. 3 Cone Type Cincinnati Milling Mach.
3 3" Morris Radial Drills.
2 2½" Morris Radial Drills.
10 11" Pratt & Whitney Auto Milling Mach.
2 No. 1 8" Pratt & Whitney Auto Mill'g Ma.
5 2 spindle Pratt & Whitney Profiling Mach.
4 No. 3 Pratt & Whitney Die Sinkers.
4 No. 2 Pratt & Whitney Die Sinkers.
1 No. 11 Pratt & Whitney Multiple Spindle (New Model Drill).
2 No. 1 Baush High Speed Multiple Drill.
5 No. 12 Pratt & Whitney Gun Barrel Drill.
34 No. 2 Pratt & Whitney Hand Millers.
3 4½x12 Pratt & Whitney Thread Millers.
3 4" Pratt & Whitney Spline Millers.
1 Pratt & Whitney Gun Barrel Drill Grinder.
1 No. 1 LeBlond Cutter Grinder.

Prices and Terms submitted upon request covering those items in which you are interested. Address, Engineering Department, Ford Motor Company.

*Ford Motor Company*

# Embossing Presses For Sale

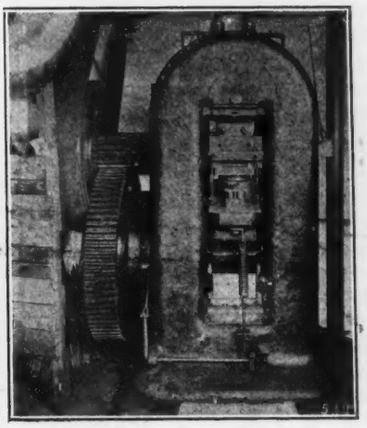
**FARRELL FOUNDRY EMBOSSING PRESS**
200 Ton Pressure



Die Space.....9″
Bed.....12″ x 16″
Packing Adjustment 1″
Gearing.....7 to 1
Belt Pulley. 24″ x 8½″
Main Gear..112″ x 7″
Floor Space...7′ x 8′
Stroke .....1¼″
Fly Wheel..48″ x 4½″
Est. Weight..7½ tons

**Price . . . $1,000.00**
**All here in Bridgeport, Conn.**

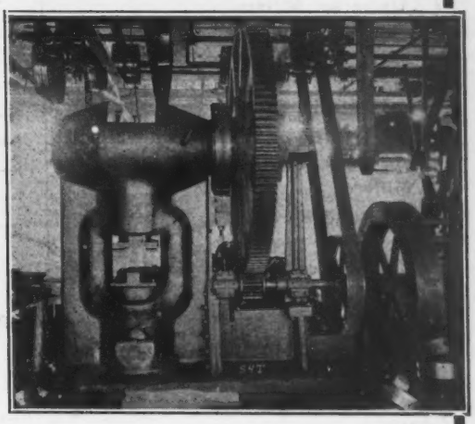
**FERRACUTE COINING PRESS—E. G. 54**
400 Tons Pressure



Die Space.....10″
Bed .....16″ x 18″
Dovetail in Gate.....
Wedge Adjustment .....¾″
Gearing.....8½″ x 1″
Belt Pulley.....32″ x 5½″
Main Gearing.....84″ x 6″
Stiles Clutch.....
Stroke ..... 1½″
Flywheel.....56″ x 8″
Floor Space.....11′ x 3′

**Price . . . . . $1,500.00**
**F. O. B. CARS**

**OTTUMWA EMBOSSING PRESS**
800 Tons Pressure



Die Space.....9″
Bed.....18″ x 16″
Dovetail in Gate.....
Wedge Adjustment.....¾″
Gearing.....6 to 1
Belt Pulley.....37″ x 7″
Main Gear.....84 teeth x 7″
Stroke ..... 1½″
Floor Space.....13½ x 6″
Shaft Diameter.....12″

**Price . . . . . $2,000.00**
**IMMEDIATE DELIVERY**

## A Few Tools in Stock

1—30″ Bullard Vertical Boring Mill, single turret head and pump, $800.00
1—24″ x 20′ Niles Screw Cutting B. G. Lathe with compound rest, hollow spindle and taper attachment for.....$1200.00
1—26 x 21′ P. & W. Screw Cutting B. G. Lathe with taper attachment. Light pattern but well worth..... $650.00
1—4 Spindle Foote-Burt Adjustable Power Feed Drill, 1″ capacity, large table..... $550.00
2—No. 4 Adriance O.B. Inclinable presses and
1—No. 20 Bliss. They will weigh about 2000 lbs. each, at each, $350.00
2—New 22 x 10 Reed-Prentice Heavy Duty Lathes, at each....$1550.00
10—No. 2 Becker Vertical Millers equal to new, each..... $500.00
No. 1 Kempsmith plain milling machine quick change gear box, used three months, price.....$1100.00
164 lb. Toledo double action press, equal to a 3½-A Bliss, reinforces, guaranteed .....$2000.00
40 lb. Bradley hammer, good condition.....$275.00
200 lb. Bradley hammer, good condition.....$600.00

*Send for our list 47*

**J. L. LUCAS & SON, Inc.,** 3 FOX STREET Bridgeport, Conn.

MACHINE TOOLS

# RELIABUILT

2—No. 1½ KEARNEY & TRECKER Universal Millers.

1—No. 2 BROWN & SHARPE Universal Miller, Vertical Attachment.

1—No. 3-B OWEN Plain Miller, Vertical Attachment.

1—No. 24 OESTERLEIN Plain Miller.

1—No. 3 CINCINNATI Universal Miller.

1—34" KING Boring Mill, Turret Head.

1—52" BULLARD Boring Mill, Two Swivel Heads, Gear Feed.

1—NEW 24" BULLARD Vertical Boring Mill, New Era Type.

1—NEW 42" BULLARD Vertical Boring Mill, New Era Type.

1—No. 1 LUCAS Precision Boring Mill.

1—BAUSH Eight Spindle Drill, Gear Feeds.

1—7' 3" WARREN Radial, Motor or Belt Drive.

2—6' PRENTICE Radials, Single Pulley Drive.

1—6' NILES Radial, Motor Drive.

1—5' BAUSH Radial, Cone Drive.

1—4' 6" BICKFORD Radial.

1—3' 6" BICKFORD Radial.

1—3" DRESES Plain Radial.

1—10' x 10' x 20' POND Planer, Four Heads.

1—36" x 36" x 16' FLATHER Planer, Two Heads.

1—36" x 36" x 8' POND Planer, Two Heads

1—52"—74" x 52" x 24' BETTS Planer, Two Heads

1—NEW 42" x 42" x 12' OPENSIDE Planer, Two Heads.

9—2¼" GRIDLEY Four Spindle Automatics No. 55.

1—No. 5 BROWN & SHARPE Universal Grinder.

2—No. 59 TOLEDO Straight Side Geared Presses.

1—No. 46 BLISS Straight Side Geared Press.

2—26" x 12' CISCO Quick Change Gear Lathes.

35—20" x 8' AMERICAN High Duty, Quick Change Gear Lathes.

1—40" x 24' FIFIELD Lathe, Triple Geared.

1—3" x 36" JONES & LAMSON Turret Lathe, Geared Head.

1—NEW 17" SIMMONS Shaper, complete.

1—20" CINCINNATI High Duty Shaper.

1—5 TON WHITING Pneumatic Crane, 37½' Span.

**Call or write for proposal**

**SIMMONS MACHINE COMPANY, INC.,** Office and Warehouse **Albany, N. Y.**

BRANCH OFFICES: 801 Singer Bldg., New York, N. Y.—804 Dime Bank Bldg., Detroit, Mich.,—358 Ellicott Sq., Buffalo, N. Y.



# USED MACHINERY

LATHES

13 x 5 South Bend Lathe with C.R.

14 x 6 Monarch Standard Engine Lathe, C.R.

15 x 6 South Bend Lathe with C.R.

16 x 8 Monarch Lathe.

16 x 8 Reed Lathe.

19 x 10 LeBlond Heavy Duty Manufacturing Lathe with double back geared head, plain rest, cross and longitudinal stops, taper attachment, raising blocks.

24 x 12 New Haven Lathe, C.R.

24 x 12 American Tool Works Single Pulley Drive Geared Head Lathe, C.R., Q.C.G.

26 x 14 Pratt & Whitney Lathe with swivel rest, T.A.

26 x 10 Hamilton Lathe with Special Ball Turning Rest, Q.C.G., Hexagon Turret mounted on ways.

PLANER

26 x 26" x 5' New Haven Planer with one head on cross rail.

DRILLS

No. 11, 8-Spindle Natco Multiple Drill with 12" circular head.

14" Leland-Gifford High Speed Ball Bearing Drill, equipped with a 1 H.P., 3-Phase, 60 Cycle, 220 Volt Motor.

GRINDERS

16" Cleveland Hole Grinder.

10 x 20 Acme Universal Cutter and Tool Grinder.

No. 16, 12 x 72" Brown & Sharpe Plain Manufacturing Grinder.

22 x 84" Pratt & Whitney Heavy Vertical Grinder with 12 x 24" Magnetic Chuck.

GEAR CUTTERS

No. 3, 26" Capacity Brown & Sharpe Automatic Spur Gear Cutter.

36" Fellows Gear Shaper.

MISCELLANEOUS

4" Hurlbut & Rogers Cutting-off Machine.

No. 2-H Becker Profiler with rotary table.

2½" Bar Niles Cone Type Horizontal Boring Machine.

4 x 80 Pratt & Whitney Thread Miller.

Electromobile Shop Truck, carrying capacity 3000 lbs., pulling capacity 10,000 lbs., two four-wheel wagon trailers and charging outfit.

Type 3-V.S.-23 National Brake & Electric Co.'s Motor Driven Air Compressor; having a piston displacement of 300 cu. ft. per minute against 90 lb. pressure; including 54 H.P. Allis-Chalmers three-phase, 60 cycle, 220 volt A.C. Motor, Type HB Control; comprising automatic governor; unloader and water valve; all mounted on common bed-plate making complete self-contained unit.

# THE W. M. PATTISON SUPPLY CO.

*Machinery Department*

CLEVELAND OHIO, U.S.A.

## Practically New and at Pre-War Prices. Surplus equipment of the Lincoln Motor Co., Manufacturer of Liberty Airplane Motors.

**BROACHING MACHINES**

2—No. 0 J. N. Lapointe.

**GRINDERS**

6—No. 18 Bryant Lnternal.
6—No. 1½ Cincinnati Cutter and Tool.
6—4 Spindle Foote-Burt Valve.
12—No. 60 Heald Cylinder.
3—12 x 24" Modern Plain.
6—10 x 50" Norton Plain.

**LATHES**

3—9 x 12 Sundstrand Mfg.
4—16 x 10 Rahn-Larmon Standard.
1—16 x 10 Rahn-Larmon Standard.
10—21" x 10' South Bend.
3—24" x 10' Lodge & Shipley Selective Head.

**MILLING MACHINES**

7—Type "A" Briggs.
6—10" Pratt & Whitney Automatic.
6—No. 15 Garvin Plain.
1—No. 22 Garvin Vertical.
2—2" Pratt & Whitney Spline.
10—No. 6 Whitney Hand.

**SCREW MACHINES**

2—No. 2 Smurr & Kamen 2" capacity.

**TURRET LATHES**

6—2¼" x 26" Cincinnati Acme Plain.
10—3¼" x 36" Cincinnati Acme Plain.

**"A FEW OF THE ADDITIONAL USED MACHINES IN STOCK"**

**BORING MILLS**

36" Bullard Vertical Turret Lathe.

**GEAR CUTTERS**

No. 3—26" Brown & Sharpe.
2—36" x 9" Gould & Eberhardt Horizontal Type.
No. 2 Whiton Automatic.

**GRINDERS**

5—No. 18 Bryant Chucking Grinders.
2—Carrigus Ring.
3—14 x 72 Norton Plain Grinders.
5—16 x 72 Norton Double Head Pin.
3—No. 60 Heald Cylinder Grinders.
3—No. 1½ Landis Grinders.
5—No. 205 Rivett Hand Oscillating.

**LATHES**

16" x 8' Monarch.
2—20" x 8' Bradford.
22" x 14' Niles.
30" x 14' Pond.
30" x 18' American.
2—9" x 12" Sunstrand.
18" Double Head Greaves & Klausman.
4—21" x 10' South Bend (new).

**AUTOMATIC MILLERS**

2—10" Pratt & Whitney.

**PISTON RING MACHINES**

3—Plain Gridleys.
2—Eccentric Gridleys.
2—No. 2-P Potter & Johnston (plain).
2—No. 2-P Potter & Johnston (eccentric).

**TURRET LATHES AND SCREW MACHINES**

6—3¼" x 36" Acme.
4—2¼" x 26" Acme.
No. 7 Bardons & Oliver.
⅜" x ½" Plain Cleveland.
2" Cleveland.
1" x 7" Acme.

**We Also Have a Large List of Tools In Our Own Stock and Solicit Your Inquiries**

**THE MOTCH & MERRYWEATHER MACHINERY CO.**

**707 LAKESIDE AVENUE, N. W., CLEVELAND, OHIO**

**DETROIT CINCINNATI PITTSBURGH**



# BACK TO PRE-WAR PRICES!!!

**LATHES**

Five (5) Fay Automatic Lathes.
50 in. x 20 ft. Pond, triple geared, face plate drive, etc.
52 in. x 24 ft. Wood Light, triple geared, face plate drive.
38 in. x 14 ft. Fay & Scott heavy duty.
38 in. x 18 ft. LeBlond, heavy type.
20 in. x 8 ft. Lodge & Shipley, geared head, pan bed.
16 in. 8 ft. Reed Prentice, quick change, etc. New.

**HAMMERS**

1500-lb. Bliss, board top.
250-ton Mesta Steam Hydraulic Quick Acting Forging Press.
1500-lb. United Engineering Co.'s Board Drop.
800-lb. Merrill, board drop.
300-lb. Bradley Helve.
100-lb. Bradley Helve.
80-lb. Yeakley, Pneumatic.

**VERTICAL BORING MILLS**

14 ft. Standard, 2 swivel heads.
10 ft. Hilles & Jones single head.
90 in. Pond, 2 swivel heads.
60 in. Niles-Bement-Pond, 2 swivel heads—heavy latest.
72 in. Bement, single head.
38 in. Baush, 2 swivel heads.
38 in. Bullard, 2 swivel heads.

**RADIAL DRILLS**

6 ft. Baush, practically new.
6 ft. Bickford, semi-universal.
5 ft. Baush, motor driven.
3½ ft. Gang, tapping.

**PLANERS**

60 in. x 48 in. x 20 ft. Gleason, 3 heads.
48 in. x 36 in x 16 ft. Detrick & Harvey, open side, 3 heads.
48 in. x 36 in. x 10 ft. Ohio, 2 heads.
42 in. x 42 in. x 12 ft. Pond, 2 heads.
30 in. x 30 in. x 6 ft. Gray, 3 heads.
30 in. x 30 in. x 14 ft. Flather, 2 heads.

**PUNCHES AND SHEARS**

No. 7 Hilles & Jones Multiple Punch, weight approx. 50,000 lbs.
Thos. Carlin Alligator Shear, 12 in. blade, capacity 1½ in. rounds.
Betts Punch, 20 in. gap, capacity 1 in. through 1 in.
Cleveland Punch, 19 in. gap, capacity ⅜ in. through ⅜ in.
Henry Pels Coping Machine, armor plate, capacity 10 in. beam.
325-ton Watson-Stillman Hydraulic Straightening Press.
Bement Horizontal Punch, 60 in. gap, main gear 72 in. x 7 in.; weight about 30,000 lbs.

**MULTIPLE DRILLS**

Bickford 10 Spindle Rail Drill, 2 in. capacity, heavy.
Two Spindle Foote-Burt, heavy duty.
Five Spindle Baush, capacity 1½ in.
16 Spindle Baush, capacity ½ in.

**PRESSES**

No. 512 Bliss.
Four (4) No. 540 Max Ams, geared 8 in. stroke.
No. 1 Bliss, straight side, 14 in. stroke.
No. 1 Farrel Arch, single crank, 10 in. stroke.
No. 6 Farrel, straight side, geared, 8 in. stroke.
No. 5 Farrel, straight side, geared, 8 in. stroke.
No. 2 Bliss, 7 in. stroke.
And 40 other presses.

# GRAVES MACHINERY EXCHANGE

**Warehouse and R. R. Siding:**
**Johnston Avenue and Monitor St., Jersey City, N. J.**
***Write for illustrated catalogue***

**Offices:**
**Suite 482, 50 Church Street, New York City, New York**
**Telephone Cortlandt 665**

# HONEST-SERVICE

## Machine Tools and Supplies located in plant of The Dayton Metal Products Co., Dayton, Ohio

### PARTIAL LIST

No. 1 Chicago Automatic Screw Machines.
No. 0 Brown & Sharpe Automatic Screw Machines.
No. 2 Brown & Sharpe Automatic Screw Machines.
No. 52 National Acme Automatic Screw Machines.
No. 53 National Acme Automatic Screw Machines.
No. 54 National Acme Automatic Screw Machines.
No. 55 National Acme Automatic Screw Machines.
No. 56 National Acme Automatic Screw Machines.
No. 515 National Acme Automatic Screw Machines.
No. 4 Foster Hand Screw Machines.
No. 3 Foster Hand Screw Machines.
No. 2 Foster Hand Screw Machines, with power feed.
No. 3 Superior Hand Screw Machines.
1 x 15 P. & W. Screw Machine, power feed.
Smurr & Kamen Screw Machines.
No. 2 Pratt & Whitney Hand Screw Machines.
2 x 24 Jones & Lamson Flat Turret Lathes.
No. 3 Lees-Bradner Thread Milling Machines.
Holden Morgan Thread Milling Machines.
No. 2 Waterbury-Automatic Screw Slotting Machines.
No. 20 Waterbury-Farrell Thread Roller, new.
No. 2 Aetna Swaging Machines.
No. 3 Langelier Rotary Swaging Machines.
No. 2 Langelier Hammering Machine.
No. 3 Langelier Hammering Machine.
American Laundry Machine Co., Washer, 36 x 48 B.T.W.C.
Yankee Universal Grinder.
Cleveland Auto. Mach. Co. Surface Grinder.
Gisholt Tool Grinder.
No. 2 Woods Universal Grinder.
Greenfield Universal Grinder.
10" Leland Gifford Drill Presses.
National Acme Chaser Grinder.
Reed Speed Lathes on legs.
1000-lb. Waterbury Chain Draw Bench, 8" Screw and 20' Bed.
Wells Turret Lathes with cut-off slide.
No. 1 Garvin Screw Machines.
¾" Webster & Perks Grinder Heads.
3/16" Rickert & Shafer Tappers.
5/16" Rickert & Shafer Tappers.

### MACHINE TOOLS
### in our Cleveland and Dayton Stores

#### New Machines

23" Snyder Stationary Head Drill Press.
25" Snyder Sliding Head Drill Press.
No. 1 Toledo Hand Milling Machine.
Webster & Perks No. 6 Polishing and Buffing Lathe.
⅜" Electric Drill.
½" Electric Drill.
No. 0 Bicket Profiling Machine.
No. 32-B Demco Floor Type Drill Press, two-spindle.
No. 32-B Demco Floor Type Drill Press, three spindle.
No. 1 Wilmarth & Morman Universal Grinder.
No. 2 Canton Floor Crane.
No. 4 Canton Floor Crane.
10 x 30 Webster & Perks Universal Grinder.
No. 5 Greenerd Arbor Press.
No. 22 Demco Bench Drills.
No. 2-B Washburn Shops Drill, two-spindle.
No. 2 Garvin Screw Slotting Machine.
No. 2 Grand Rapids Universal Grinder.
10 x 30 Webster & Perks Cylindrical Grinder.
Webster & Perks No. 1 Floor Type Grinder.
No. 2 Toledo Hand Screw Machines.
No. 1 Racine Hack Saw 6 x 6".
6 x 6" Peerless High Speed Metal Saw.
9 x 9" Peerless High Speed Metal Saw.
Webster & Perks No. 1 Bench Grinder.
Assorted sizes Drill Chucks, Lathe Chucks and Boring Tools.

#### Used Machines

14 x 6 Rockford Plain Lathe.
18 x 8 Greaves & Klusman Lathe.
18 x 6 Seneca Falls Lathes, quick change gear.
No. 1 Wilmarth & Morman Surface Grinder, good condition.
12" x 6" Gould & Eberhardt Gear Hobbers.
24" x 12" Gould & Eberhardt Gear Hobbers.
No. 1 Cleveland Boring Mill—2½" bar.
No. 1 Two-spindle Garvin Tapping Machines.
No. 1 Brown & Sharpe Automatic Screw Machine.
No. 2 Bardons & Oliver Turret Lathe.
No. 3—26" Brown & Sharpe Gear Cutters.
No. 1 Warner & Swasey Hollow Hex Turret Lathe, bar and chucking.
No. 3-A Warner & Swasey Hollow Hex. Turret Lathe.
2 x 24 Jones & Lamson Turret Lathes.
3 x 36 Jones & Lamson Turret Lathes.

# THE BIGGS-WATTERSON COMPANY

Branches: Dayton, O. CLEVELAND, O. Detroit, Mich.

## THIS LIST SHOULD HELP YOU

1—18' Niles Plate Planer for ¾" plates, belt driven, in excellent condition.
1—No. 2 B. & S. Auto. Screw Machine.
1—Newton 48" Rotary Plain Planing Machine.
1—No. 3 Farwell Gear Hobber.
1—18" Gould & Eberhardt Gear Hobbing Machine.
1—4-spindle 22½" Barnes Gang Drill.
1—16 x 8' Seneca Falls Q. C. Engine Lathe.
1—32 x 32 x 8' New Haven Planer, 1 head.
1—18 x 8' Rockford Q. C. Engine Lathe.
2—No. 4 B. & S. Wire Feed Screw Machines.
1—No. 2 Garvin friction head, power feed Screw Machine.
1—2½" Acme Double Head Bolt Cutter.
1—No. 13-B Brown & Sharpe Plain Milling Machine.
1—No. 2 Knight Vertical Drilling and Milling Machine.
1—27 x 30" x 8' Gray Planer, 1 head on rail.
1—24 x 30" x 8' Gray Planer, 1 head on rail.
1—26 x 30" x 8' Ohio Planer, 1 head on rail, with power elevation.
1—6 x 30" Norton Plain Cylindrical Grinder.
1—No. 2 Cincinnati Universal Grinding Machine.
1—No. 1½ B. & S. Universal Milling Machine, with dividing head.

## THE E. A. KINSEY COMPANY

CINCINNATI INDIANAPOLIS

## GUARANTEED MACHINE TOOL BARGAINS

1—42" Bullard Vertical Boring Mill.
1—42" Gisholt Boring Mill.
1—No. 1 Lucas Boring Mill—95 per cent new.
1—No. 3 Becker Vertical Milling Machine.
1—No. 3 Cincinnati Plain Milling Machine.
1—No. 4 Cincinnati Plain Milling Machine.
1—No. 2½-B Milwaukee Vertical Milling Machine.
2—No. 3-A Warner & Swasey Hollow Hexagon Turret Lathes.
2—8 x 60 Low Swing Lathes.
2—28" x 16' Bradford Engine Lathes raised to swing 44".
1—30 x 36 x 10' Cincinnati Planer.
2—20" Gould & Eberhardt Shapers.

## M. J. WALSH MACHINERY CO.

141 Sycamore Street, Milwaukee, Wisconsin

# "BATH" CLEVELAND | Selections from Stock

AUTOMATICS

2¼" and 4¼" Model A Cleveland Automatics, in very good condition, with large equipment.

3—No. 33 New Britain Automatic Chucking machines, 5 stations and tapping spindle, handle work up to 2½" diameter in chuck jaws and 5½" swing outside chucks, very good.

BAR STOCK MACHINES

5—2 A Warner & Swasey 5-bar and chucking; very good.

BORING MILLS

1—30" Gisholt Boring Mill, single pulley drive, rapid traverse, 3-jaw chuck, good as new.

42" Niles Vertical Boring Mill, one swivel, one turret head, 3-jaw table, fine condition.

72" Bullard Double Swivel Head Boring Mill, gear feed, cone drive, 4 face plate jaws, may be inspected in operation.

BULLDOZER

No. 5 Ajax Hi-Speed Bulldozer with steel bed and cut gears; in first class condition.

DRILLS

20", 22½", 24" and 28" Sibley Drill Presses, new. Also two 20" Sibley Drill Presses, second hand.

2-spindle 24" Barnes all geared drills, pump and piping; fine shape.

3—Sibley & Ware Drill Presses.

1—22" Rockford Drill Press.

4—Large Colburn D-3 Hi-Speed Drills; very good condition.

GEAR CUTTER

No. 3—26" Brown & Sharpe plain gear cutter with all parts, very good condition.

GRINDERS

1—Cincinnati No. 1 old style cutter grinder, complete, good shape.

4—Woods Tool & Cutter Grinders; good as new.

Wet and Dry Yankee Drill Grinders.

No. 3 Landis Universal Grinder, takes 12" x 42".

18" Bryant Internal Grinder, late model, excellent condition.

3—No. 60 Heald Cylinder Grinders, first class.

HAMMER

1—No. 6 B Nazel Air Forging Hammer, weighs 32,000 lbs., practically good as new.

LATHES

1—19" x 8' LeBlond Lathe, steady and follow rests, countershaft, etc.

2—18" x 8' Mueller Engine Lathes, quick change gear, double back geared, very good condition.

2—20" x 8' Walcott Engine Lathes, quick change gear, countershaft, etc.

24" x 11' Johnson compound rest Engine Lathe, in very good condition, complete with standard equipment.

MILLING MACHINES

1—Billings & Spencer Die Trimming Improved Miller; first class condition.

No. 00 Brown & Sharpe Plain Hand Miller.

No. 25 Becker Plain Horizontal Miller; almost new.

No. 3-B heavy Brown & Sharpe Hi-Power; fine shape.

No. 4 Brown & Sharpe cone type with dividing heads, vertical attachment, etc., very good.

1—A B 1 Becker Hi-Power Vertical fully equipped with oil pump and countershaft.

1—No. 3 Becker Universal Miller with dividing heads, vise, countershaft, etc.

PLANERS

22" x 22" x 5' J. S. Wheeler Planer with one belt on each side, quick return to table, in first-class operating condition.

36" x 36" x 14' Pond single head planer in good condition, with table 6" thick, no broken T slots or pegged gears, a good rugged tool, fine condition.

PRESS

1—No. 78½ Bliss straight side press, Tie Rod Frame, knockout rods, etc.

SAWS

2 Metal Band Saws.

3—Peerless Hi-speed 6"; new.

SHAPER

1—24" Juengst Horizontal Crank Shaper, worm gear drive; good condition.

MISCELLANEOUS

1—No. 0 Ajax Return Roller; very good.

**CYRIL J. BATH & CO.,** Machinery Merchants 721 St. Clair Ave., N.E., CLEVELAND, O.



# Government Sale of (New) Machine Tools

**Sealed bids will be opened at 10 A.M. August 26, 1919, at War Department, Surplus Property Division, Munitions Bldg., Washington, D. C., for any or all of the following:**

**26-TOOL GRINDING MACHINES, with motor, No. 82½ Safety Emery Wheel Co.**

**1-ARBOR & FORCING PRESS, 100 ton, Fairbanks, Morse Co.**

**3-FOOT-LEVER PRESSES, No. 9, E. W. Bliss & Co.**

**13-HACK SAW MACHINES, with motor No. 7, Atkins**

**1-BELT LACING MACHINE, 12", Peerless Belt Lacer Co.**

**1-HEAVY DUTY SHAPER, 20", Cincinnati Shaper Co.**

**Full particulars and special bid forms may be obtained at the above Office or Zone Supply Offices, attention Surplus Property Officer in the following Cities: Boston, New York, Philadelphia, Baltimore, Newport News, Atlanta, Jeffersonville, Ind., Chicago, St. Louis, New Orleans, San Antonio, Omaha, El Paso, San Francisco.**

# UNUSUAL OFFERINGS

1—48 x 48 x 18′ 4-head double housing Dietrich & Harvey heavy duty planer practically new.

2—No. 0 Giddings & Lewis horizontal boring machines with supplemental table, 3 boring bars and facing head.

1—2½″ bar Cleveland horizontal boring machine.

1—12″ Dill slotter.

1—10″ Pratt & Whitney vertical shaper.

2—30 x 60 x 16′ extension bed LeBlond gap lathes.

NOTE—These items are a selection from our JULY list—DID YOU GET A COPY?

**MOREY AND COMPANY, Inc.** (Formerly MACHINERY MERCHANTS, Inc.)
50 CHURCH STREET NEW YORK, N. Y.

# LIST OF MACHINERY

## At the Spencer Engineering Co., Toledo, O.

9—American 18 geared head sgl. pulley drive engine lathes, 8′ bed.

11—American 18″ geared head turret lathes, 8′ bed.

14—American 18″ double back geared turret lathes, 8′ bed.

21—American 18″ double back geared engine lathes, 6′ bed.

22—American 16″ double back geared engine lathe, 6′ bed.

1—American 16″ turret lathe.

10—Smalley-General thread milling machines equipped with air chucks, air cylinders and valves.

3—Various size grinding jacks.

1—No. 4 Gardner disc grinder.

1—No. 14 Besly disc grinder.

17—Townsend wet grinders.

3—Norton grinders.

1—16 x 8 American tool room lathe, taper attachment, compound rest.

1—26″ Barnes Drill.

1—Industrial 48 x 16 lathe, compound rest.

1—G. E. 3 ph. 60 cy. 220 volt motor, 720 R.P.M., oil starter.

1—Gould & Eberhardt 20″ milling machine.

3—Gray shot blast machines.

1—Tool hardening furnace.

6—Baker boring machines, latest type No. 416.

1—Oil pump, cap. 5 gal. per minute.

1—Air hoist 14″ dia. 8′ lift.

2—Air hoists 8″ bore, 8′ lift.

2—Quigley annealing furnaces, 8′ wide, 32′ long.

1—10 Barrel steel tank, 5 x 6 x 3′4″, steam jacketed.

1—3 Barrel steel tank, 42 x 36 x 30 deep.

2—Air tanks with valves and gauges.

2—Hydraulic banding presses.

2—Hydraulic pumps.

2—Hydraulic accumulators.

2—Shell spraying machines.

47—Air chucks with air cylinders and connections.

2—Roller marking machines.

1—Prentice geared head 18 x 8 turret lathe with carriage.

There is also in this plant a large quantity of pulleys, all sizes, line shafting, hangers and belting of all descriptions. Also a large stock of tool room and stock room supplies.

**The Cleveland Belting & Machinery Co.**
CLEVELAND, OHIO, U. S. A.

MACHINERY DAVID A. WRIGHT EQUIPMENT CHICAGO

# MACHINERY

55 slightly used Foster hand screw machines, sizes 1, 2, 4, 5 and 10.
2—No. 3 Federal screw machines.
1—No. 1 Webster & Perks Univ. grinder.
1—No. 3 Modern Univ. grinder.
1—52″ Niles wheel lathe.
1—90″ Niles wheel lathe.
1—No. 2 Niles Axle lathe.
16, 20 and 24″ Queen City shapers.
14 x 6′ Filsmith Q.C. lathes.
2—30″ x 10′ Lodge & Shipley geared head lathes.
Nos. 3, 4, and 5 Hardinge Cataract bench lathes.
2—14 x 6 Mulliner toolroom lathes.
2—12 x 5 Mulliner toolroom lathes.
2—15—22″ x 8′ Gap lathes.

Large stock of new and used machinery of all kinds. Send us a list of your requirements for our prices.

**David A. Wright, Chicago, Ill.**

# The Osborne & Sexton Machinery Co.

*RELIABLE MACHINE TOOLS*

Columbus Ohio

## NEW AND REBUILT

PLANERS
36 x 36 x 18 Pond 1 Head.
32 x 32 x 10 Niles 1 Head.
24 x 24 x 8 American 1 Head.
22 x 22 x 6 Gray 1 Head.
36 x 36 x 16′ Niles 2 Heads.

RADIALS
4½′ Universals.
4′ Baush Plain.
3½′ Morris Plain, New.
3′ Canedy-Otto Plain, New.

GRINDERS
10 x 30 W & P Universal, New.
10 x 24 Landis Universal.
10 x 20 Litter, Plain.
Cincinnati Universal Cutter.

PRESSES
Perkins Dbl. Crank 16 x 24 Bolster.
32P Toledo 2,400 lb. (5).
No. 5 Garrison Inclinable.

TURRET LATHES AND SCREW MACHINES
No. 6 Warner & Swasey.
1—⅝″ S & K Fric. Bk. Grd. (3).
1½″ Tilted Turret, Fric. Bk. Grd.
2 x 24 and 3 x 36 J & L Sgl. pulley.
⅜″ Hartford and P W Automatics.

MISCELLANEOUS
Compressors 8 x 8 and 12 x 10.
Hammer 55 lb. Justice.
Hammer 75 lb. Beaudry.
Milling Machine No. 4 Cinti.

## SOME BIG ONES

60 x 60 x 18 Betts Planer.
12 O. B. I. Presses, 1, 2, 3.
Covington 10′ 6″ Press.
12′ Boring Mill, 2 Heads.
10′ Plate Shear for ⅜ Plate, 15″ Gap.
Motor 75 H.P., 3 Phase, 220 Volt.
Straightening Rolls 57″ Bet. Hzgs.
Plating Dynamo, 2500 Amps.

# LARGE HYDRAULIC PRESS

with platens 10½′ x 3′, 1375 tons capacity.

2¼″, 3¼″ and 4¼″ Gridley Automatics, new at very low price.

3′ Radial Drill.

4 Bench Precision Profilers, new.

3″ Cleveland Automatic.

48″ x 48″ x 12′ Planer, 4 heads, almost new.

**MACHINESHOP EQUIPMENT CORP'N**
170 Oliver St. BOSTON

# FOR SALE

The following list of slightly used machines, at decided reductions from regular prices:

1—42″ x 20″ x 20′ Ingersoll Miller.
1—⅞″ Garvin Turret Lathe.
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1—No. 55 Acme Automatic.
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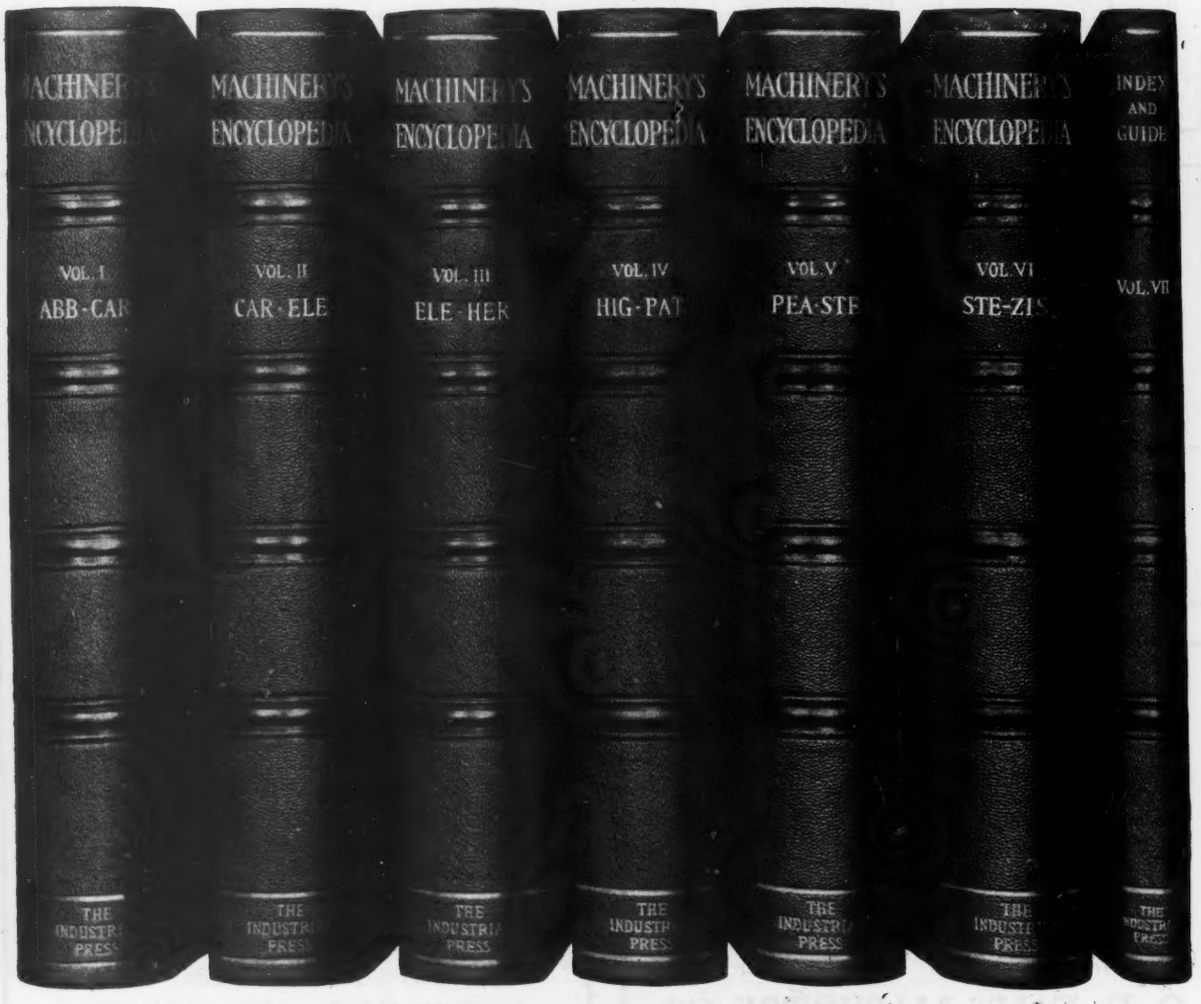


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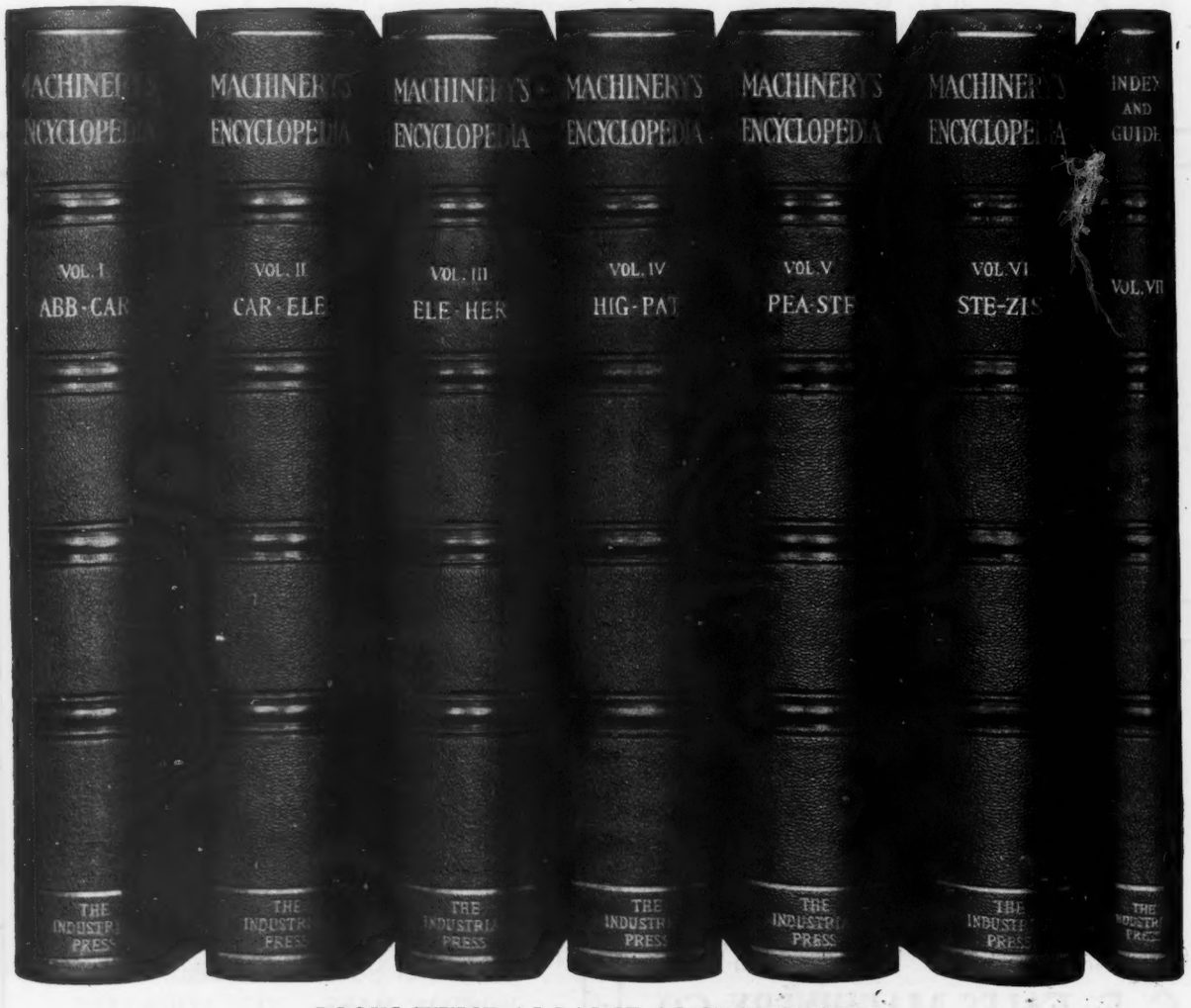


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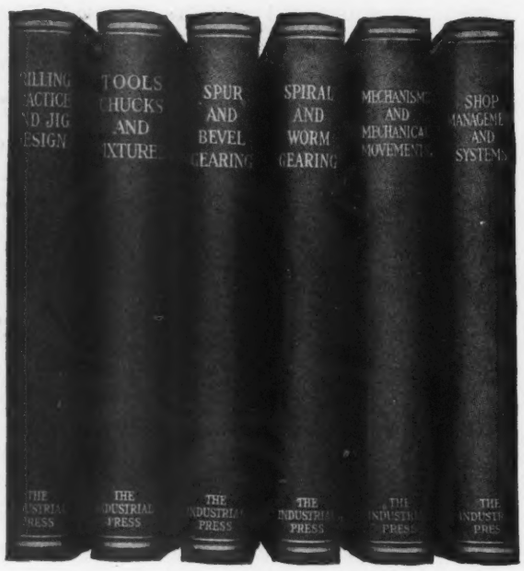


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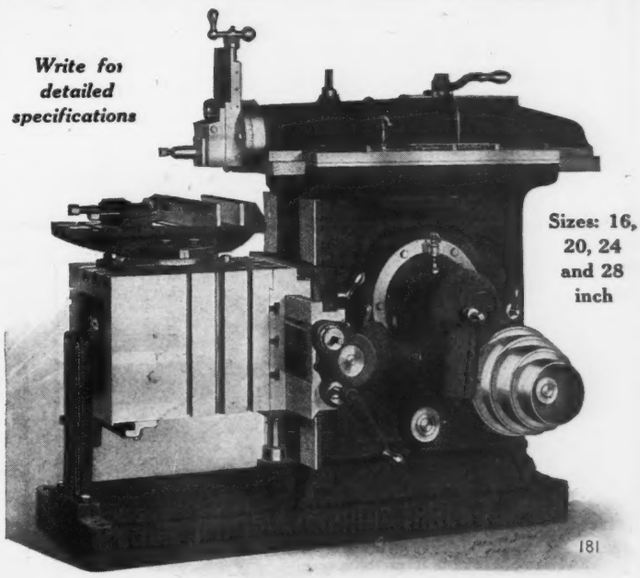

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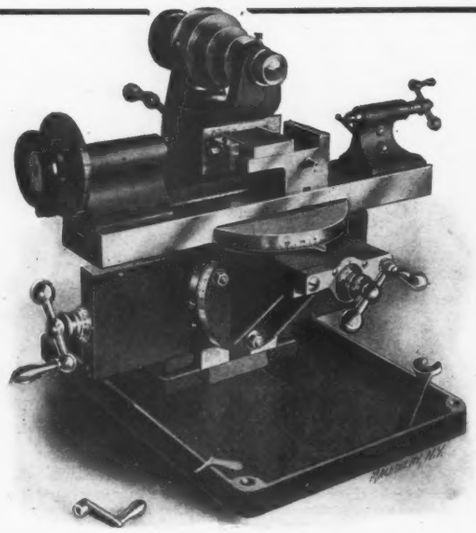

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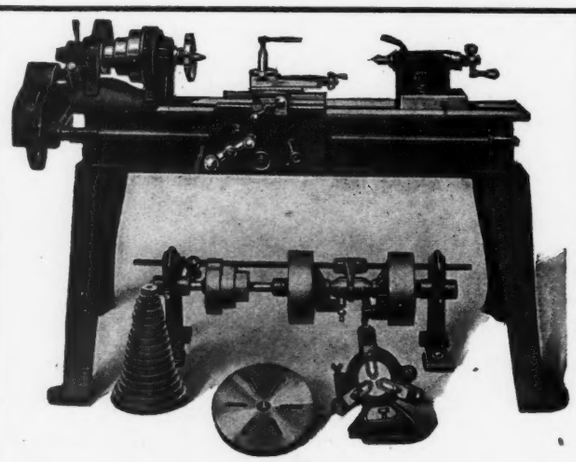

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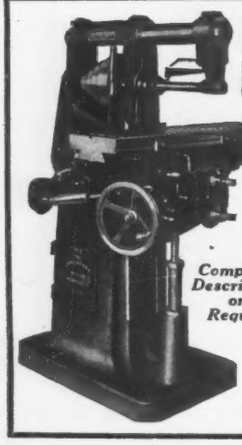

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*IDEAL FOR DIE WORK*
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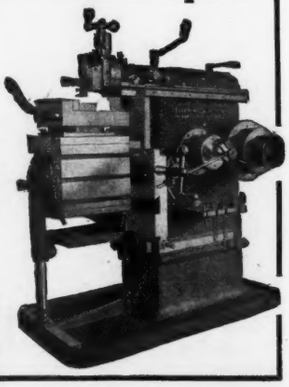
Distinctive features include micrometer readings on all adjustments, Sellew Patented Outboard Table Support, universal adjustment of tables for planing compound angles, etc., and countershaft with two sets of tight and loose pulleys running in the same direction.



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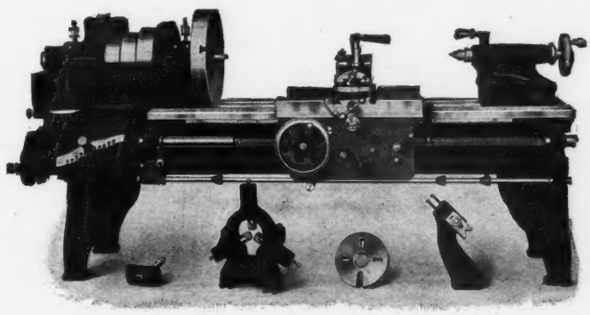
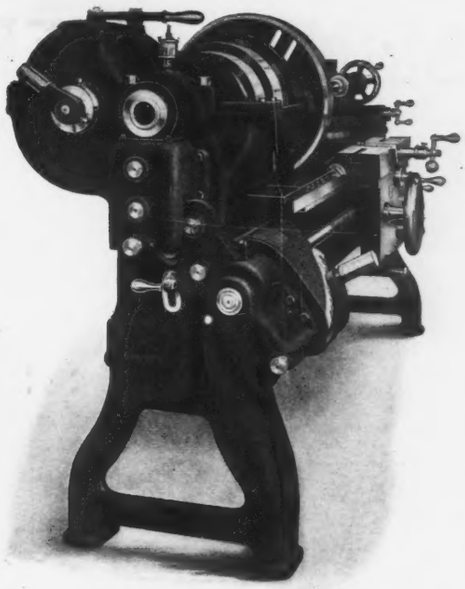


Front view Cisco 18" Lathe



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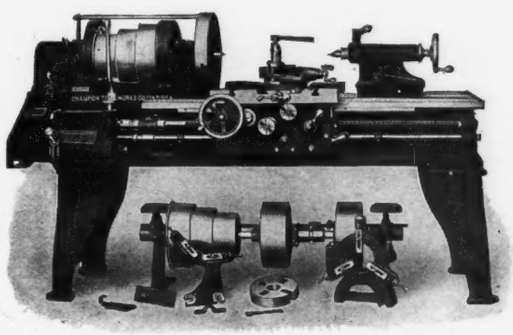

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Rigid, accurate machines that drive high-speed cutting tools to their limit. The quick-change gears, the automatic stop for either direction, the friction cross and length feeds and other features make these lathes economical machines for use where rapid production is necessary.

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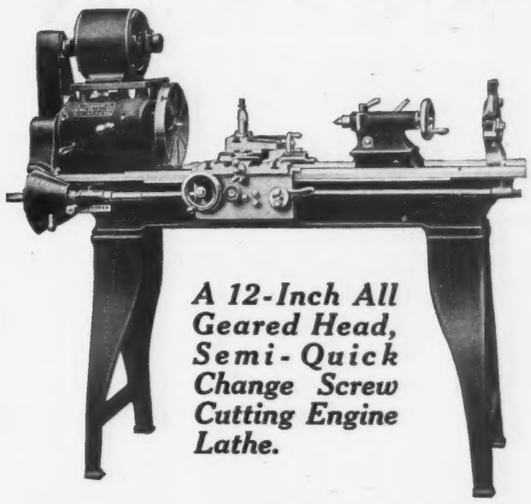

***A 12-Inch All Geared Head, Semi-Quick Change Screw Cutting Engine Lathe.***

All gears are of steel in the headstock of this practical little toolroom lathe. A reversing lever—also in the headstock—permits the feed to be instantly stopped or reversed without stopping the machine, shifting the belts or changing the direction of the rotation. This feature greatly facilitates thread cutting and with other advantages recommends the "New Shepard" for a variety of tool and instrument work. *Details?*

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Countersunk or any other type of riveting can be produced with *absolute uniformity and maximum* production on these machines.

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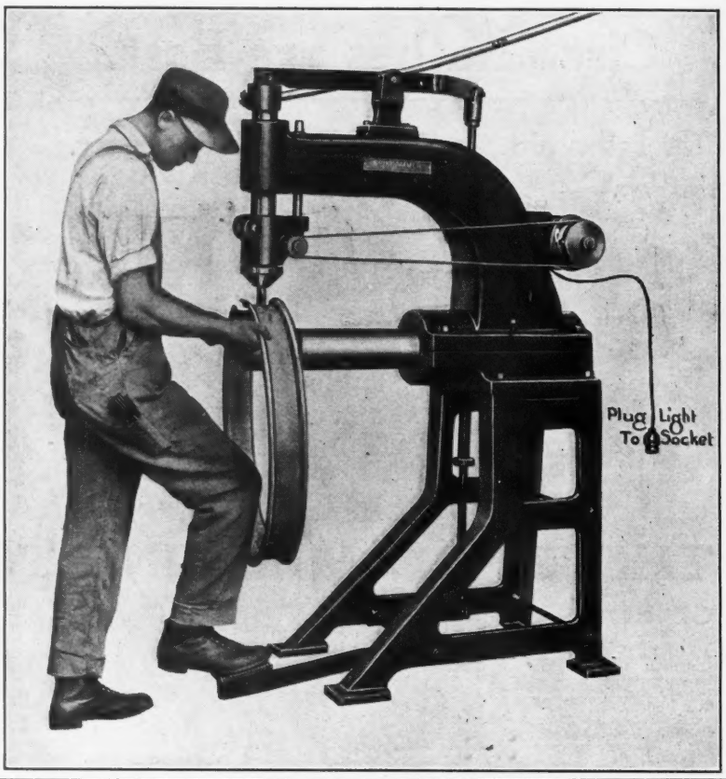


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# ANDERSON DIE FORMING MACHINE

***"The Machine that Cuts Continuously"***

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You can try this 60 per cent better producer (proved) for 30 days in your plant at our expense. If it doesn't do all you expect, send it back. The rotary cutters have shearing edges in the form of a hardened multiple ratchet screw thread. A continuous cut is secured, and, unlike with the filing machine, the work will be drawn down on the table, and may be applied to the cutter from whatever direction is most convenient to the operator. *Write today.*

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The Ideal Batch Process Metal Cleaning Machine will remove the heaviest grease or drawing compound from stampings or drawn parts. The work is held in the drum passing through and through the circulating cleaning compound until it is thoroughly cleaned. The whole batch is then automatically discharged at once, making way for a batch of entirely different work if desired. By this method it will wash work which it is impossible to clean in any other way. Ideal Metal Cleaning Machines are made in single drum type, also in double drum type, with heated screen for washing, rinsing and drying. Capacity up to 60,000 pounds daily.

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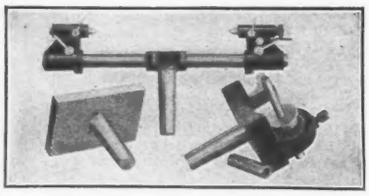

You'll find it reliable and a wonderful time saver in gauging duplicate parts and tools, in checking concentricity, etc., where limits are close. Graduations are in .0001" and equipment includes center test attachment, gauging table and bushing and form cutter concentricity test attachment. Complete description on request.

Height, 17"
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"Standard Throughout the World"

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## Hydraulic Marking Machine

is smooth running without vibration or noise. By using this hydraulic system the machine automatically takes care of any variance, which might exist in the thickness or diameter of the pieces to be marked, and leaves a clear uniform impression.

*Let us send you detailed information concerning this machine*

*The Marking Machine People*

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Will Not Splinter—Cannot Split

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Comfortable handles that hold the tool securely. An inserted steel tube takes the strain of the tool shank—a steel ferrule locks the tool fast. Send for our circular—see the handles at your dealers.

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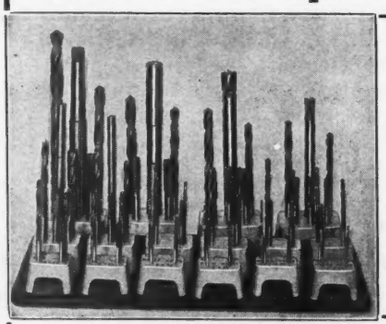

*Economy in every shop*

*Time Saver*

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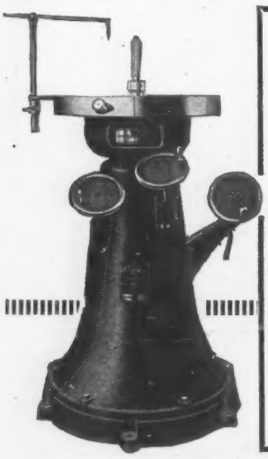

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# CRAWFORD DYNAMIC BALANCE

*Indicates Exact Counterweight and Plane*

*Further details on request*

This machine indicates the exact amount of counterweight and the exact plane where the weight should be placed to produce a running balance in bodies such as flywheels, pulleys, rotors, gear wheels and clutch assembly parts. A new machine, designed on a new principle.

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# SHOOT THE PIECES THROUGH

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In demagnetizing parts with the "Columbia" it's simply a matter of dropping the pieces through the central opening, one at a time, two at a time, or a quantity together. Do you want to keep parts together in sets? Follow the method of the man in the photograph—put them in a wire basket. In at the top, out at the bottom, and the contents—inserted cutter teeth which had been ground on a magnetic chuck—are entirely demagnetized. No adhering chips can now interfere with their smooth cutting action.

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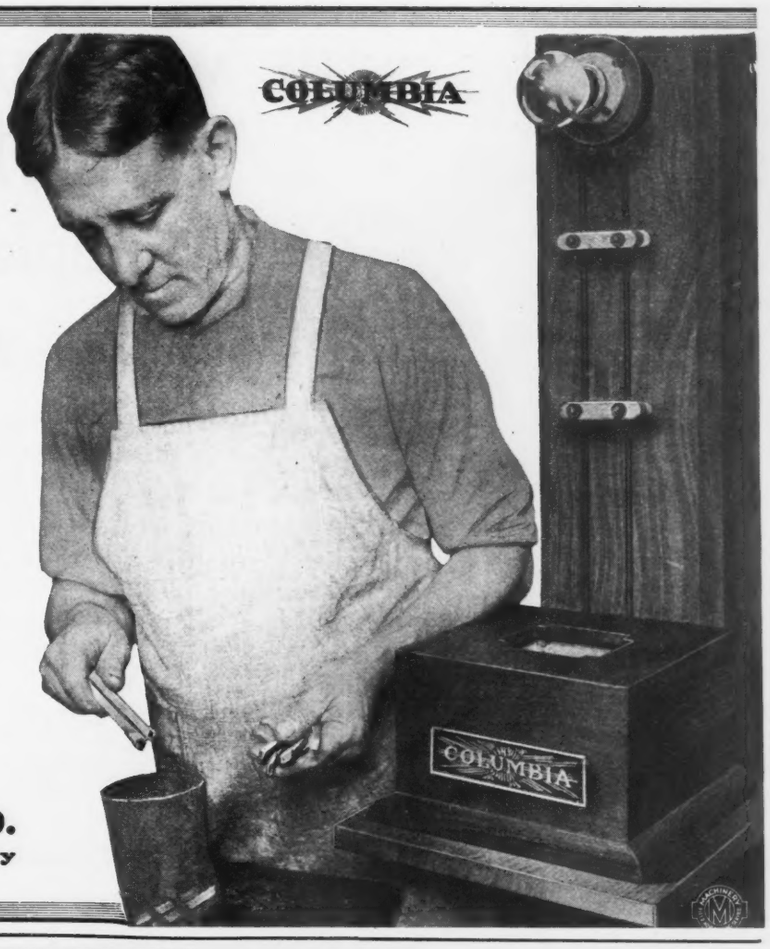


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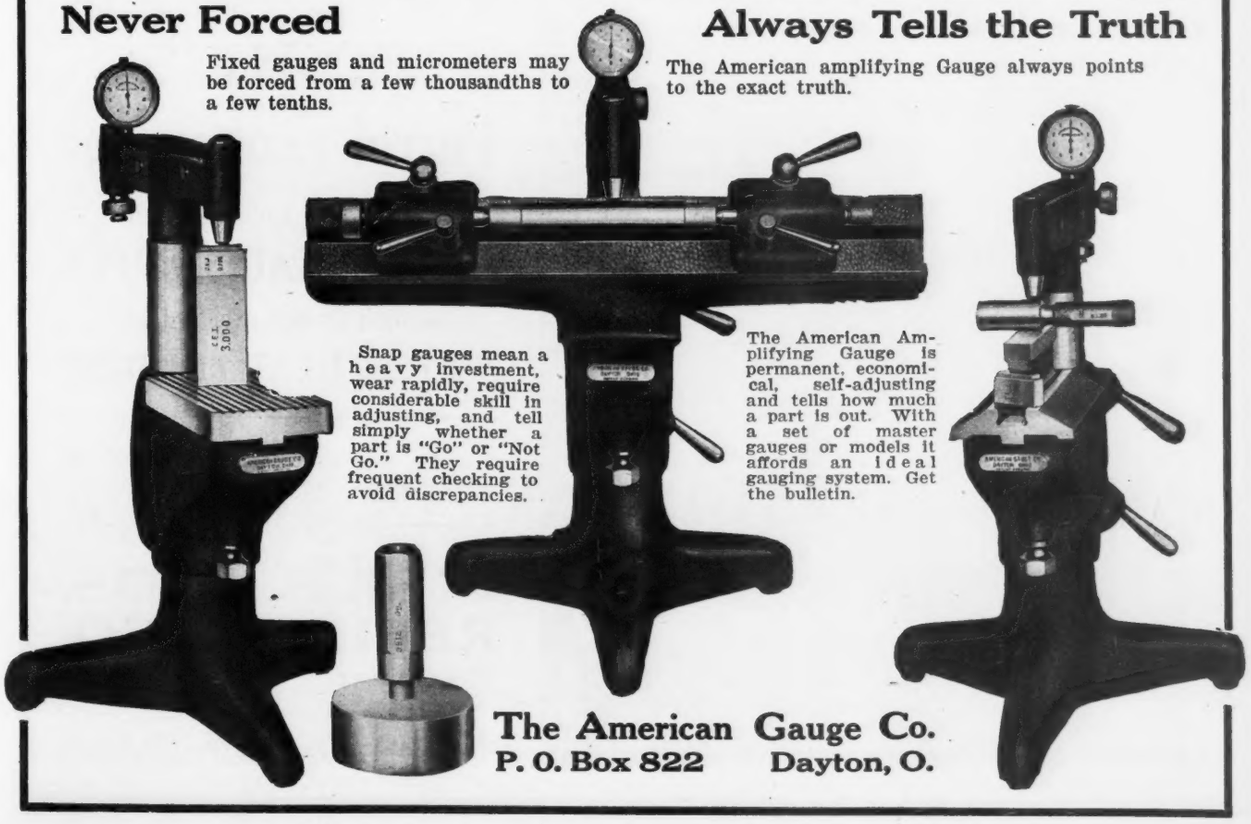
## Never Forced

Fixed gauges and micrometers may be forced from a few thousandths to a few tenths.

## Always Tells the Truth

The American amplifying Gauge always points to the exact truth.



Snap gauges mean a heavy investment, wear rapidly, require considerable skill in adjusting, and tell simply whether a part is "Go" or "Not Go." They require frequent checking to avoid discrepancies.

The American Amplifying Gauge is permanent, economical, self-adjusting and tells how much a part is out. With a set of master gauges or models it affords an ideal gauging system. Get the bulletin.

**The American Gauge Co.**
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## Multiple Spindle Drill

***Makes Every Minute Count Double***

We'd like to give you some actual production figures. This, better than any other way, will enable you to tell why you need Harrington Multiple Spindle Drills in your plant.

*Write to-day*

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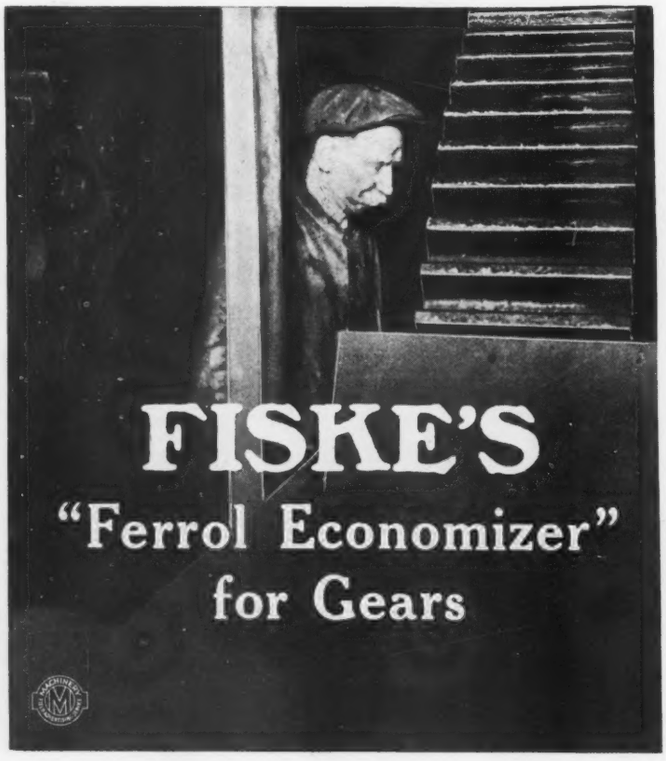
***Gears of the type illustrated working under enormous pressure and adverse conditions are doing the work easily with the aid of***

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The Ideal Lubricant for

**GEARS, CHAINS, ROPES**

Which is not affected by

**WATER, HEAT and DUST**

*Just drop us a line for a circular which tells what it is and how to use it.*

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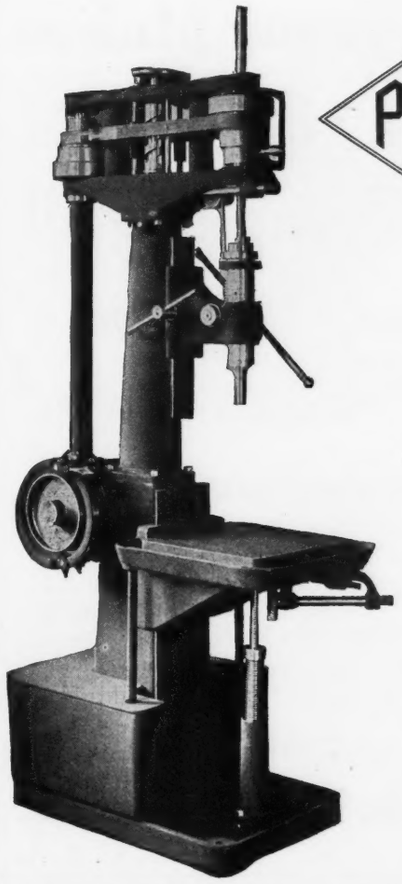

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# High Speed Drilling Machine

***Worth Its Cost Because the Value is there***

**A quality machine for economical production. Worth more because it earns more.**

A modern drilling machine made by modern methods. The Pierle is a departure from type—it marks a distinct advance in drill press construction. It's a real high speed machine—runs at 2,250 R.P.M., and works the best H. S. S. twist drills to the limit. Every revolving part is balanced; the best ball bearings—SKF—are used; there's no vibration.

*One to eight spindles. Write for details.*

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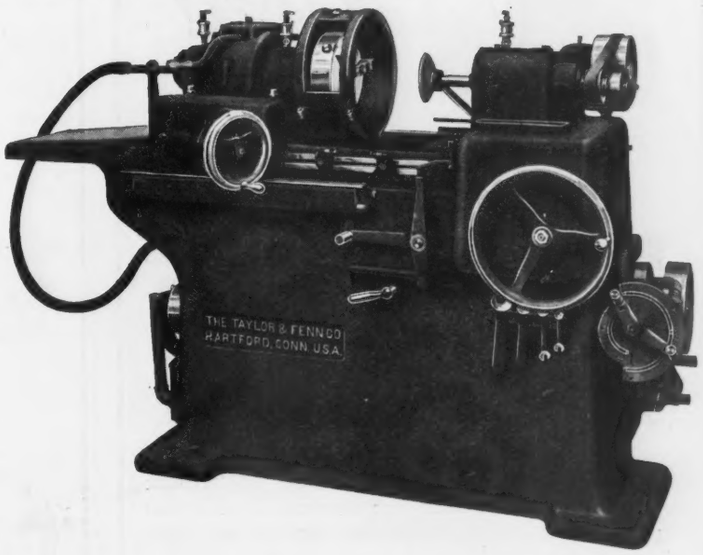
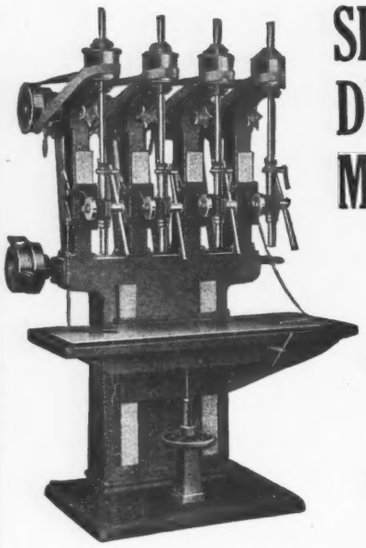
The construction of the stationary wheel head, spindle and drive, also elimination of overhead countershaft are new special features which reduce vibration to the minimum and assure rapid, accurate production.

Table and cross slide move on large V and flat ways. Controls are arranged for convenience and ease of the operator. Bores 8″ diameter 8″ long can be ground. The many special features of this machine deserve your careful attention. Ask for details.




**THE TAYLOR & FENN CO., Hartford, Conn.**

## High-Grade Ball-Bearing



## SENSITIVE DRILLING MACHINE

With One to Four Spindles, With 7/8" capacity

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**FRANCIS REED COMPANY**

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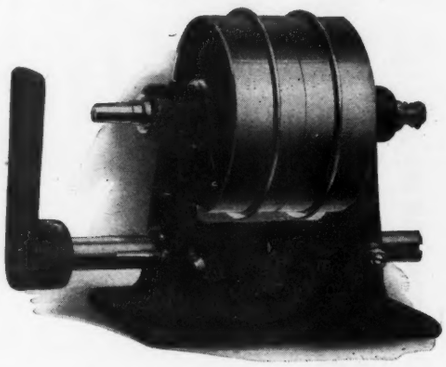

**Improvements**

made in our Nos. C and D Machines have reduced the movement from drive to reverse to 1/8". This quick reverse speeds production, lessens the danger of scoring the thread and reduces tap breakage.

Accurate, efficient, economical machines with capacity to 3/8" (type C) and 5/8" (type D).

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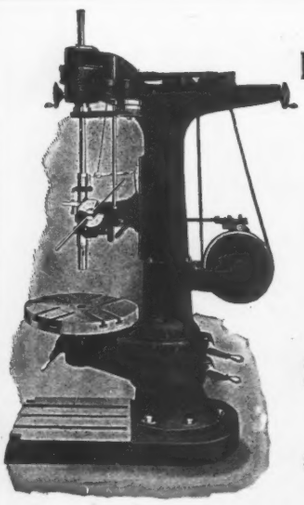
**The Burke Machine Tool Co.**

Conneaut Ohio, U. S. A.



THE DRILLING MACHINES included in THE *Avey* LINE embody

**STYLES AND SIZES**

Suited to Every Field of Sensitive Drilling

OUR No. 3 MACHINE (capacity 1 1/8") is furnished with

**Round Table and Flat Working Base**

as above illustrated or may be provided with the standard square table with vertical adjustment

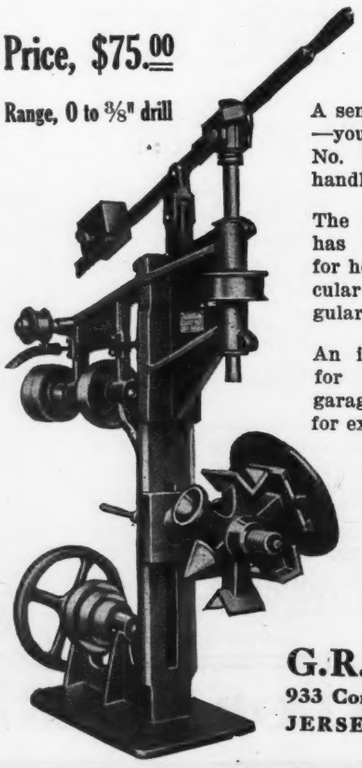
PUT YOUR DRILLING PROBLEMS UP TO US
We will gladly make recommendations
IT COSTS NOTHING TO ASK

**The Cincinnati Pulley Machinery Co., Cincinnati**

## MELLON DRILL with the MONITOR TABLE

**Price, $75.00**

Range, 0 to 3/8" drill



A sensitive drill press—you can "feel" a No. 55 drill in the handle.

The Monitor Table has six positions—for holding shafts, circular parts, balls, angular pieces, etc.

An ideal bench drill for assembly floor, garage, repair shop, for experimental work.

*Attractive agency proposition for certain territories*

**G.R.MELLON**

933 Communipaw Avenue
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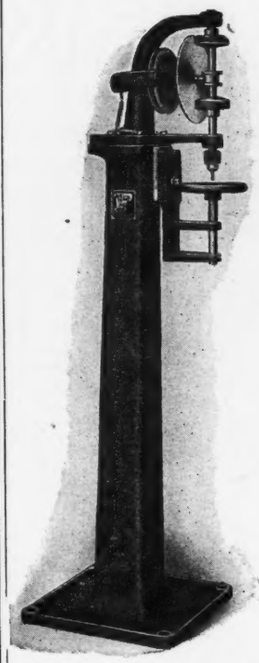

# FENN TAPPING MACHINES

have sensitive control that reduces tap breakage; adjustable friction rolls that simplify speed changes and enable the operator to secure high speed for running taps out.

Economical, efficient modern machines for tapping up to 3/16".

*Ask us for Circular.*

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W. L. FENN & W. A. FENN

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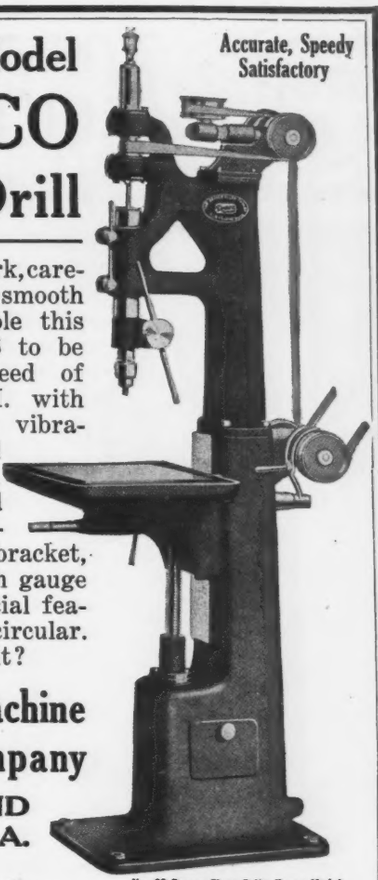
Heavy Model

# DEMCO Floor Drill

Accurate, Speedy Satisfactory

Rigid framework, careful balance and smooth operation enable this Demco No. 36 to be run at a speed of 12,000 R. P. M. with practically no vibration. Detailed description of the four speed changes, adjustable quill bracket, improved depth gauge and other special features in the circular. May we send it?

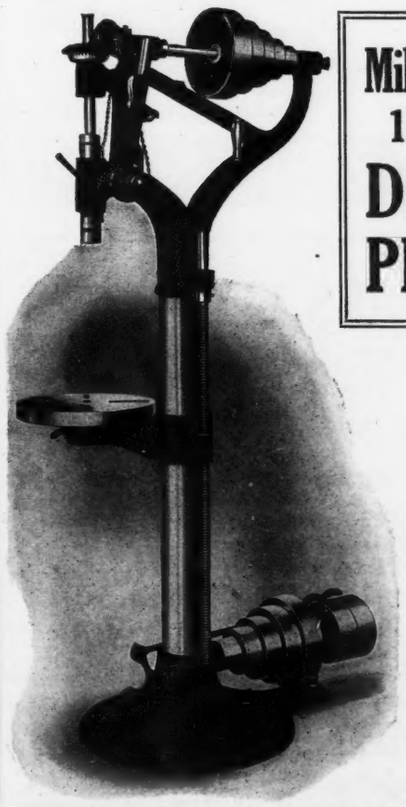


No. 36 Demco Floor Drill, Heavy Model Furnished with A, B, C or D Spindle

**Demco Machine Tool Company**

CLEVELAND OHIO, U.S.A.

*Successors to The DeMooy Machine Co*



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We manufacture other sizes.

Our prices will interest you.

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# HAWES SENSITIVE RADIAL DRILLING MACHINE

*Capacity to 3/4". Send for more details.*

A new radial with unusual features. The spindle is mounted on one end of an arm arranged to slide on a bearing on top of the main column; the driving motor is mounted on the other end of the same arm which is locked positively in any position.

If it is a belt or wheel polishing machine, we can build it.

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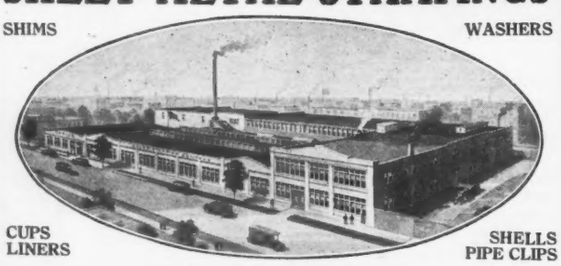

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*Contract work solicited*

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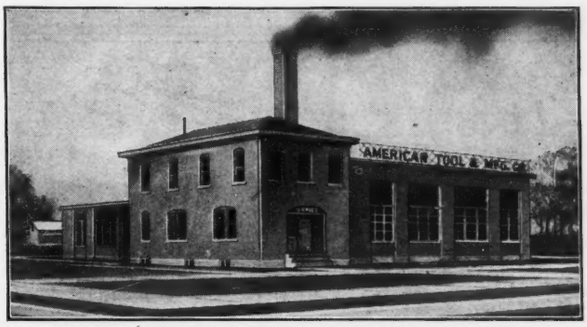


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Our entire efforts have always been directed to quality output. Reputation was the foundation upon which our plant was erected and that reputation becomes more firmly established with every shipment of our work. When your needs are

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we can do the job as you would have it done.

*We design as well as construct. Let us hear your problem*

**AMERICAN TOOL & MANUFACTURING CO., URBANA, OHIO, U.S.A.**

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Designers and Builders of

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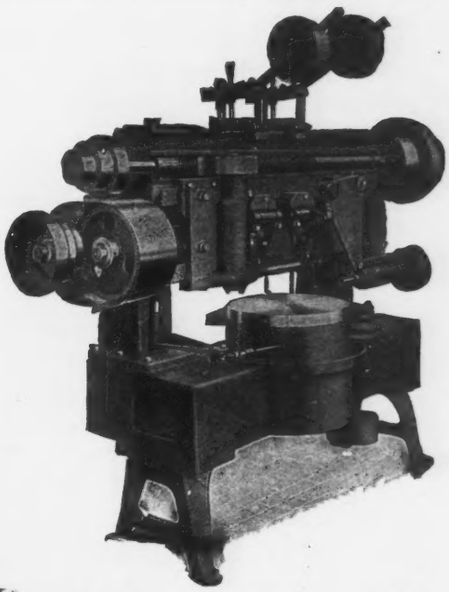

Special Milling and Drilling Machine

**MOLINE MACHINERY COMPANY**
MOLINE, ILL.

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*Our Experience and Facilities at Your Service*

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When you come to the big H, stop and consider if you really are getting your

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as you'd like them. If you are not, remember the quality and service this big H stands for. Get quotes.

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WE continually emphasize the cleanliness and orderliness of the new Krasberg plant, because we believe that nothing has as important a bearing on the success of what one produces as the conditions under which the producer works.

Complete, correct equipment and contented, competent men are the powers that reared the most efficient contract shop in the world.

***Who Is Your Toolmaker?***

## *This Is a Toolmaker's Office*

That we have seen many toolmakers' offices accounts for the pride we take in our own. The idea is all too common that an office is exempt from the rules that apply to the rest of a plant —that a desk is a graveyard for papers, books and industrial and personal what-nots.

The Krasberg plant is modern *throughout.* The office is bright, clean, airy, sanitary. Business is handled in this atmosphere quickly, cheerfully and intelligently. Krasco service is real service—begins at the beginning.

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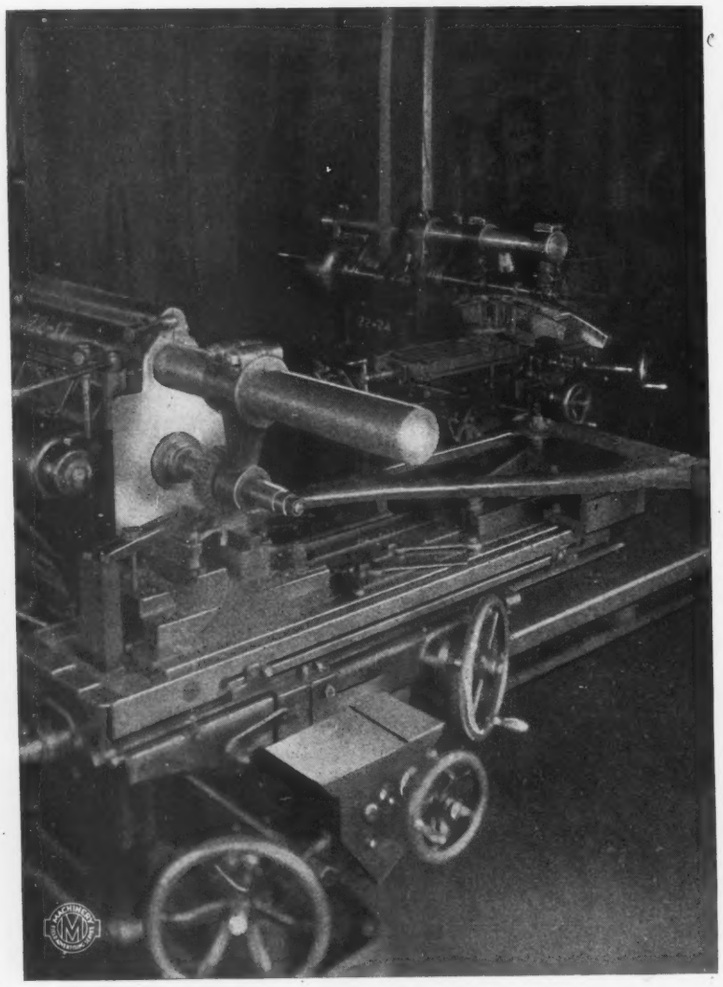
Gage making is an art. We've developed it to the point where Urbana Gages are wonders of precision, finish and durability. Of all the things we do here in Urbana we take greater pride in none than the gages turned out by this department. Are you satisfied with *your* gages.

**URBANA TOOL & DIE COMPANY, Urbana, Ohio**

# Big Results in Big Machines

## And a Big Equipment to Build Them



Our machine tool equipment is enormous, and thoroughly representative. We're proud of our personnel—justly so. And it's a point of pride with them to solve difficult problems. Write and tell them yours.

THE STEEL PRODUCTS ENGINEERING COMPANY
SATISFACTION
PRODUCTION
WE DESIGN and BUILD SPECIAL MACHINERY
EFFICIENCY
SPRINGFIELD OHIO

If you could see at one time every job the Steel Products Engineering Co. has turned out, the long life of complicated monsters would startle you.

We specialize in the largest and most intricate machines.

If you haven't entirely worked out your equipment requirements give us your ideas in embryo — tell us what you are going to manufacture—and we'll design machinery with you, or for you.

**STEEL PRODUCTS ENGINEERING CO.**

**SPRINGFIELD** **OHIO, U. S. A.**

# *What Is a Special Machine Worth?*

THE worth of a special machine depends on how nearly it does exactly what *you* want it to do—how closely it fits the plan in *your* mind.

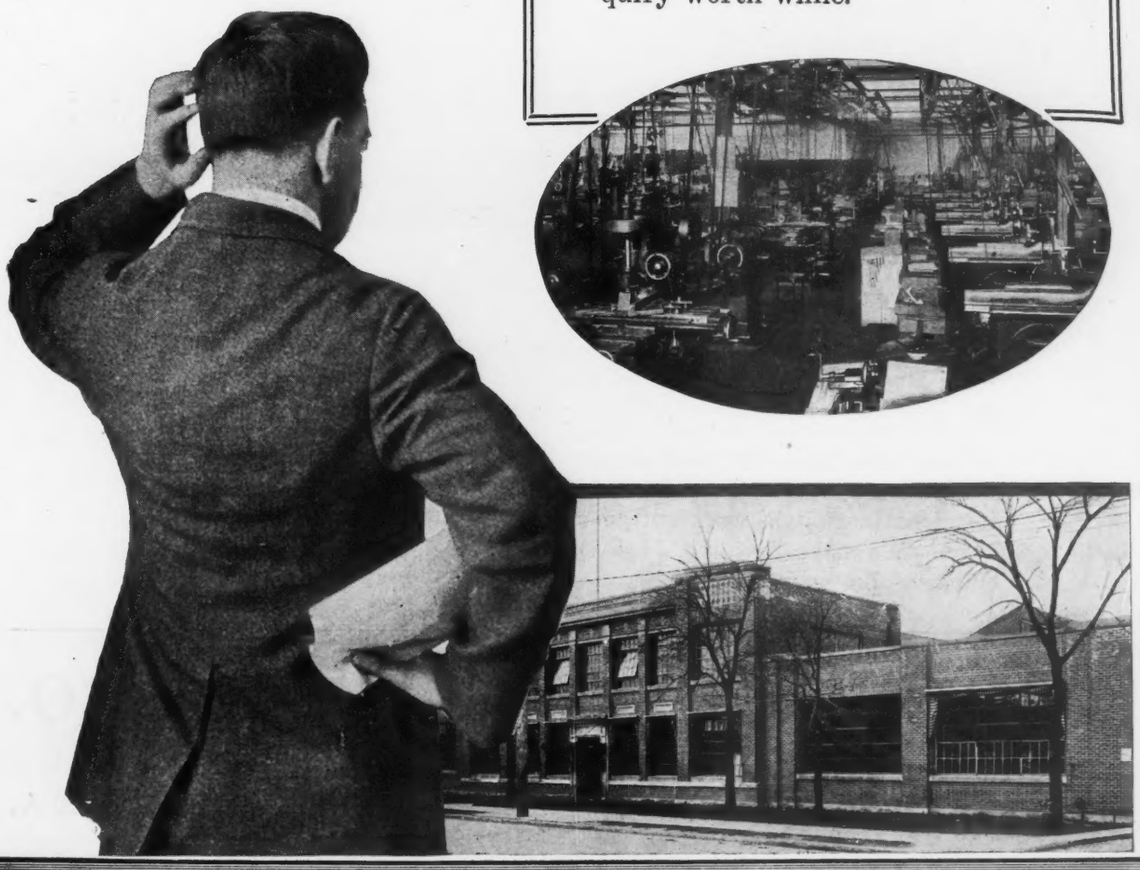
Whether or not you get the most worthy special machine depends on your choice of a maker. Profit by the experience of others in the matter of choice.

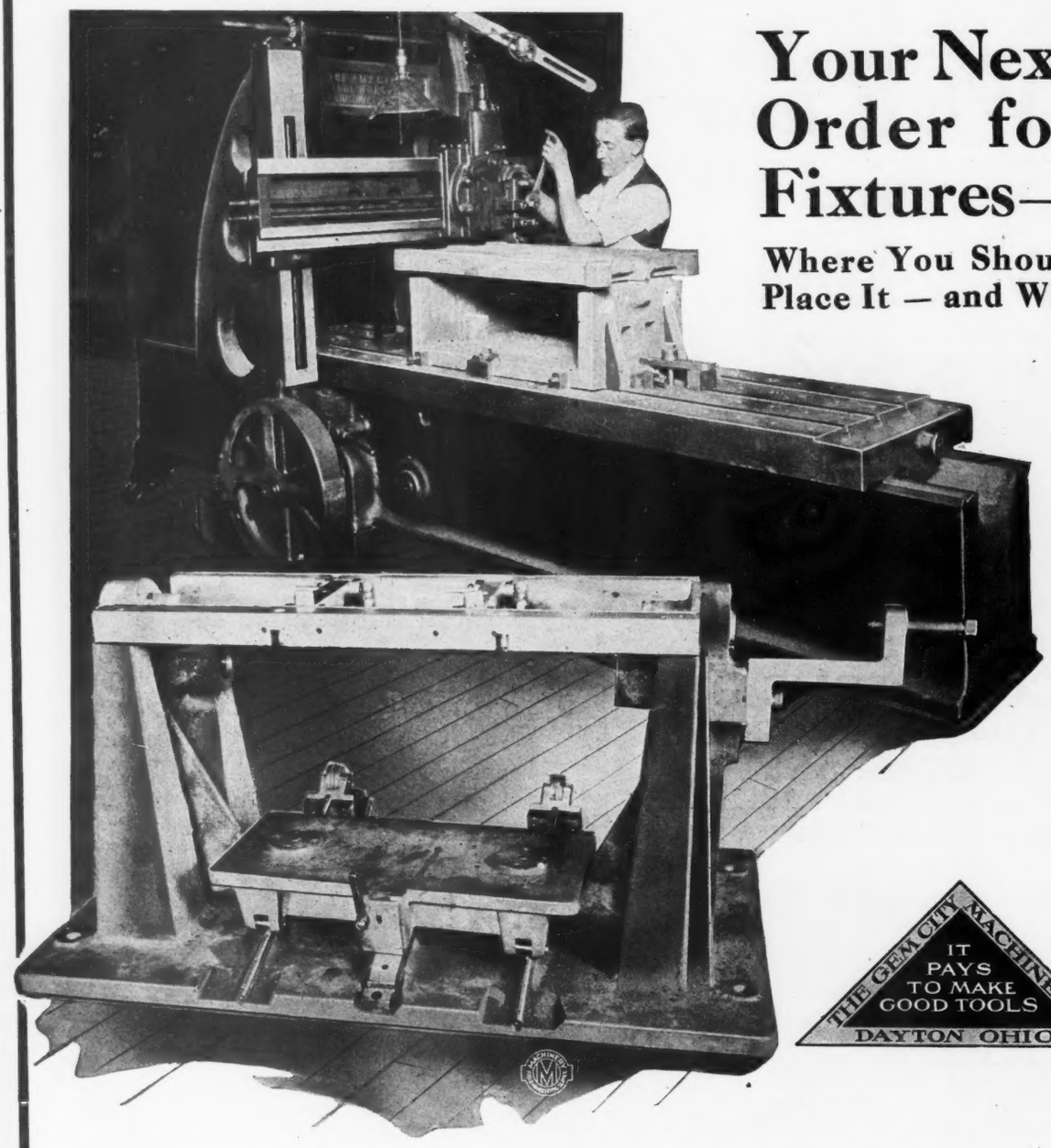
Ask us to tell you what we've done for those who picked the Columbus Die, Tool and Machine Company to make their special machines. We'll make your inquiry worth while.

*The*
**COLUMBUS DIE TOOL & MACHINE COMPANY**

**COLUMBUS** **OHIO, U. S. A.**







# Your Next Order for Fixtures—

## Where You Should Place It — and Why

THE GEM CITY MACHINE CO
IT PAYS TO MAKE GOOD TOOLS
DAYTON OHIO

ARE you a user of fixtures—of exceptional size, of unusual intricacy? Must they conform to more than ordinarily close limits?————We can give you what you want, when you want it, the way you want it.

We have the men. Our machines are large enough for any operation. Our measuring equipment is the best of its class—and complete. Our engineering department will work out your problems—design equipment to meet them. We make Fixtures, Jigs, Dies, Gages, Special Machines and Machinery. Let us work with you—you'll be pleased with the result.

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# THE GEM CITY MACHINE CO.

**Manufacturing Machinists**

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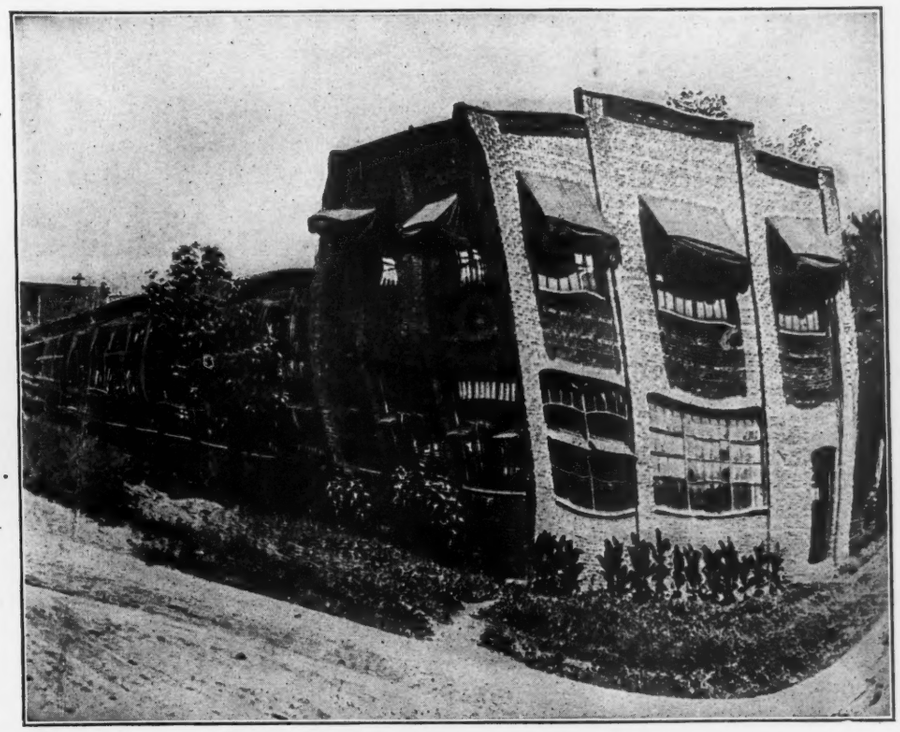
# THE TRADE MEHL MADE MARK TOOL SHOP IS BULGING WITH ORDERS!



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**BECAUSE** Our policy of fair dealing constantly results in re-orders. Mehl designers are engineers of manufacturing experience. Both mechanics and equipment are the best obtainable. All this results in the good name the TRADE MEHL MADE MARK has earned everywhere.

You know what TRADE MEHL MADE MARK tool service has done for others

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## DESIGNERS & BUILDERS

of all kinds of

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Factory, 5-7 Oliver Street

# Make Yourself at Home In Our Shop

We are official toolmakers to many prominent manufacturers. Our five-story plant houses three separate departments—for tool and gage work, contract work and manufacturing—each one completely equipped. Reliance quality is recognized; accuracy and durability are unsurpassed; and manufacturers who make themselves at home in our shop find Reliance products more economical also.

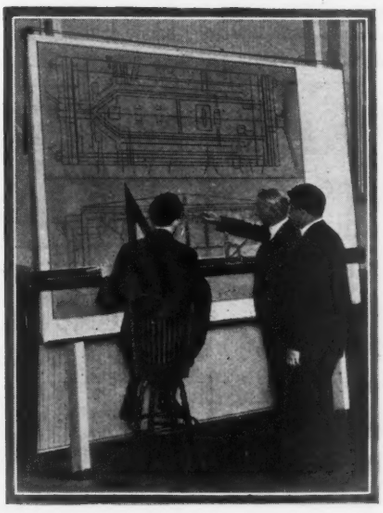
If you need dies, gages or fine tools, stampings or other contract work, or if you have a good idea which you haven't time or space to develop to a marketable stage, we invite you also to make yourself at home in our shop.

*Let us estimate on your requirements*

## RELIANCE DIE & STAMPING COMPANY
515 NO. LA SALLE ST. CHICAGO, ILL., U. S. A.

# WHO MAKES BIG JIGS FOR MULTIPLE DRILLING?

We've developed this end of the tool business to a high state of perfection. We've been working with the multiple drill users and manufacturers, helping them to get the utmost from their drilling machines and we're ready to help you also.



If you need jigs for your multiple drills, or if you have work you think *might* be more profitably drilled on multiple machines, we'll be pleased to consult with you and show just what can be done along these lines.

**Carroll**

## Tool Engineers and Builders

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*Our facilities are at your command— for Dies, Tools, Jigs, Fixtures, Special Machinery and other work of a special or intricate character.*

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We can give you quick deliveries on special
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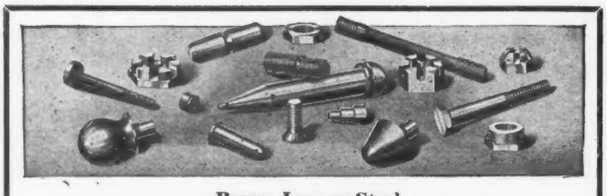
Get Our Estimates

*Special Machine and Tool Work, Manufacturing, Screw Machine Work and Stamping*



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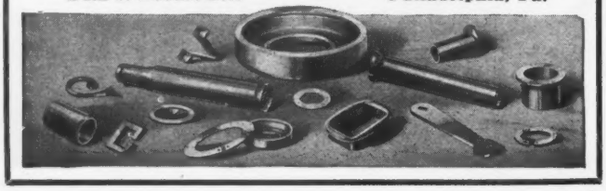

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No factory complete without one. Makes every kind of springs. Right or left-hand.
Capacity to 3/32 wire $1.25
Capacity to 3/16 wire 2.50
Capacity to 5/16 wire 5.00
*If interested, send for circular.*

(Patented)

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Works: Woburn, Mass.

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**WOOD AND METAL**
ESTIMATES QUICKLY FURNISHED WITHOUT CHARGE
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With unexcelled equipment for the economical handling of heavy, gray iron castings, this foundry is at your service. Good castings in quick time.

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**SPECIAL SPRINGS**
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TOOLS - DIES - GAUGES

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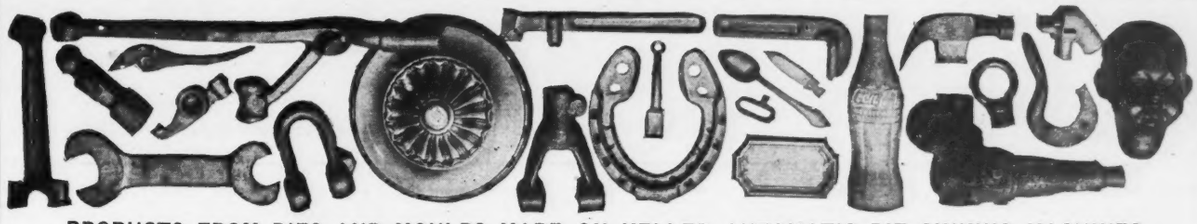
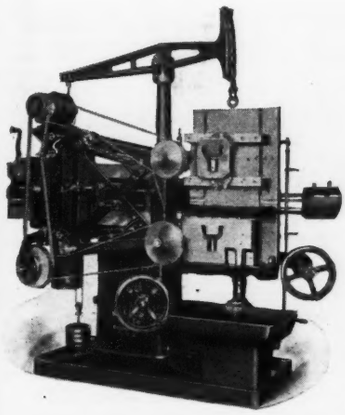
SPECIAL - MACHINERY



PRODUCTS FROM DIES AND MOULDS MADE ON KELLER AUTOMATIC DIE SINKING MACHINES

illustrating a few of the innumerable industries in which the KME METHOD is successfully used.

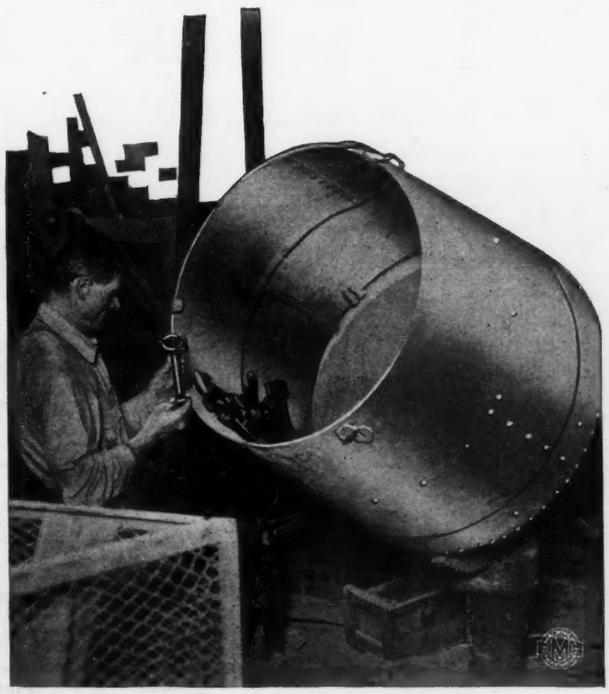
Keller Machines, of many types and sizes, cut entirely AUTOMATICALLY the most difficult dies—in infinite variety. Hundreds are in successful operation. The list of users includes the leading and most efficient plants in America and abroad.



Keller Machines are the SOLUTION of the DIE PROBLEM in all its phases. They helped to win the war—they make quantity automobile production possible.
What is YOUR product?
What is YOUR problem?
If DIES enter into either—investigate the KME METHOD.

Keller Mechanical Engraving Company, 74 Washington St., Brooklyn, N. Y.

# GLOBE TUMBLING PARTS *for* THE FRANKLIN CAR



GLOBE Tumbling Barrels have been in use at the H. H. Franklin Co. plant in Syracuse, N. Y., for nearly two years. Front axle yokes, washers, universal joint flanges, bearing retainers and connecting rods are just a few of the parts which pass through GLOBE Tumbling Barrels before machining. The barrels are of the larger sizes, measuring 24″ and 32″ across the open end. Weight of average charge is 200 pounds. Sawdust or sand is mixed with pieces, choice depending on nature of work. In some cases, water is added to sand in approximately the proportion of 1½ or 2 buckets of water to ¾ of a shovel of sand. Average run is 2 hours per batch.

***GLOBE Tumbling Book gives all details. Send for a copy.***

## THE GLOBE MACHINE & STAMPING CO.

Also Manufacturers of Sheet Metal Stampings, Dies and Tools.

1250 W. 76th St. CLEVELAND, OHIO

# CLASSIFIED ADVERTISEMENTS

## SITUATIONS, HELP WANTED, FOR SALE, ETC.

**Advertisements in this column, 20 cents a line, seven words to a line. The money should be sent with the order. Answers addressed to our care will be forwarded. Original letters of recommendation should not be enclosed to unknown correspondents.**

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**SHOP AGENTS.**—Live men to distribute our tools. Good chance. WELLES CALIPER CO., Milwaukee, Wis.

**WANTED.—DESIGNERS** of automatic machinery. Good opportunity for first-class men. 44-hour week. Good pay. Address THE HARTFORD RUBBER WORKS COMPANY, Hartford, Conn.

**WANTED—MACHINE TOOL SALESMAN** of proven ability to sell in New York State, one only who has made good need apply. Box 67, care MACHINERY, 148 Lafayette Street, New York.

**WANTED. — EXPERIENCED TOOL STEEL SALESMAN** to sell high speed and carbon tool steel, also small tools such as twist drills, milling cutters, hack saw blades, etc. Splendid opportunity for right party. State experience and salary wanted. Box 81, care MACHINERY, 148 Lafayette St., New York.

**WANTED** by a Michigan machine tool house, three experienced machine tool salesmen for the state and city to sell new and used equipment. Must have knowledge, experience and be live wires. Give full particulars. Address Box 35, care MACHINERY, 148 Lafayette St., New York.

**WANTED AGENTS.**—Saunders' Pocket "Hand Book of Practical Mechanics" for tool chest, $1.00 only. Why pay more? It fills bill for shop kinks, ready reference, simple arithmetic. Send for circular. E. H. SAUNDERS, 216 Purchase St., Boston, Mass.

**SALESMAN REQUIRED IMMEDIATELY.**—Man thoroughly acquainted with Bakelite and Condensite Products. Preference given to one with mold construction experience but this is not essential. Apply letter only to DARE MOLDING CO., INC., 333-6th Avenue, Newark, N. J.

**DESIGNING AND DETAIL DRAFTSMEN**—For permanent positions with large manufacturing concern in New England. Men with electrical, steam engine, turbine or special machine experience. Apply, giving age, experience, education and salary expected by addressing "CHIEF DRAFTSMAN," Box 73, care MACHINERY, 148 Lafayette Street, New York.

**WANTED.—A TECHNICAL SCHOOL GRADUATE** with several years of practical machine-shop experience, to instruct apprentices in a modern machine-shop engaged in the repair and maintenance of the machinery and equipment of a steel plant. Excellent opportunity for a live wire. In reply please state age, education, experience and salary expected. Also say when available. Applications will be treated in strict confidence. Address Box 83, care MACHINERY, 148 Lafayette St., New York.

**YOUNG MAN AS ASSISTANT TO FOREMAN** in New York City factory making small electrical goods, one who has had experience with modern factory systems and handling help. Education in mechanical engineering with some electrical knowledge desirable. Permanent position with opportunity for advancement. Box 70, care MACHINERY, 148 Lafayette Street, New York.

**INSTRUCTORS WANTED.**—The College of Engineering of the University of Illinois is in need of several instructors in steam engineering and mechanical engineering laboratory practice; one instructor in railway mechanical engineering; one instructor in ceramic engineering; one instructor in highway engineering; and two instructors in general engineering drawing at salaries of $1500 to $1800 for ten months. Technical graduates having some practical and teaching experience desired. Inquiries should be accompanied by a complete statement of training and experience, a recent photograph and a list of references. Address DEAN C. R. RICHARDS, University of Illinois, Urbana, Illinois.

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**SALESMEN** to carry Special Indicating Calipers as side line into manufacturing plants in mechanical line. Write us stating territory covered and goods you are handling now. I. C. C., 506 East 19th St., New York City.

**WANTED.—EXPERIENCED FILE MAKER** to act as superintendent. Must be expert and know how to organize file factory. Must have best of references. Good position for right man. Give age, salary expected. Box 78, care MACHINERY, 148 Lafayette St., New York.

**MACHINE TOOL DESIGNER.**—Company manufacturing large machine tools now making plans for extensive additions to line, desires first-class man as Chief Designing Engineer. Size of company and responsibilities attached to position make it necessary that applicant has executive ability and wide experience in the design, manufacture, and use of machine tools. Applications are solicited only from high grade men and to receive attention must give full details as to education and experience. Salary commensurate with position. All replies will be considered confidentially. Box 80, care MACHINERY, 148 Lafayette St., New York.

### SITUATIONS WANTED

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**PATENTS SECURED.**—C. L. PARKER, Ex-member Examining Corps, U. S. Patent Office. Instructions upon request. McGill Building, Washington, D. C.

**PATENTS.**—H. W. T. JENNER, patent attorney and mechanical expert, 622 F St., Washington, D. C. Established 1883. I make a free examination and report if a patent can be had, and the exact cost. Send for full information.

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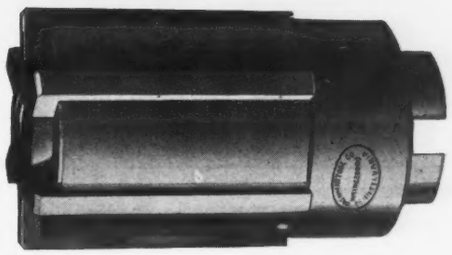

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### Accumulators, Hydraulic
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Elmes Eng. Works, Chas. F., 222 N. Morgan St., Chicago, Ill.
Hydraulic Press Mfg. Co., 84 Lincoln Ave., Mt. Gilead, O.
Niles-Bement-Pond Co., 111 Broadway, New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Treadwell Engineering Co., Easton, Pa.
Watson-Stillman Co., 192 Fulton St., New York.

### Air Hoists
See Hoists, Air.

### Alloys, (Tungsten, Uranium, Vanadium, etc.)
Haynes Stellite Co., Kokomo, Ind.
Ludlum Steel Co., Watervliet, N. Y.
Standard Alloys Co., Pittsburgh, Pa.
Vanadium-Alloys Co., Pittsburgh, Pa.

### Angle Plates, Universal
Boston Scale & Mch. Co., Roxbury, Boston, Mass.
Nelson Tool Co., Inc., Newark, N. J.
Reid Bros Co., Inc., Beverly, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

### Anvils
Yost Mfg. Co., Meadville, Pa.

### Arbor Presses
See Presses, Arbor.

### Arbors and Mandrels, Expanding
Alert Tool Co., Philadelphia, Pa.
American Mch. Products Co., Detroit, Mich.
Cochrane-Bly Co., Rochester, N. Y.
Manufacturers Equipment Co., Waller and Fillmore Sts., Chicago, Ill.
McCrosky Tool Corp., Meadville, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Western Tool & Mfg. Co., Springfield, O.
Whitman & Barnes Mfg. Co., Akron, O.

### Arbors and Mandrels, Solid
Advance Tool Co., Cincinnati, O.
Alert Tool Co., Philadelphia, Pa.
American Mch. Products Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Detroit Reamer & Tool Co., Detroit, Mich.
Detroit Twist Drill Co., Detroit, Mich.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland, O.
National Twist Drill & Tool Co., Detroit, Mich.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pratt & Whitney Co., Hartford, Conn.
Rogers Works, Inc., J. M., Gloucester City, N. J.
Skelton Tool Co., Cleveland, O.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes Mfg. Co., Akron, O.

### Babbitt
Ajax Metal Co., Philadelphia, Pa.
Besly & Co., Chas. H., 120-B North Clinton St., Chicago, Ill.
Doehler Die-Casting Co., Court and Ninth Sts., Brooklyn, N. Y.
Lumen Bearing Co., Buffalo, N. Y.

### Balancing Machines
Anderson Bros. Mfg. Co., Rockford, Ill.
Crawford Tool & Mfg. Co., 1617 So. Crawford Ave., Chicago, Ill.
Dafiance Mch. Wks., Defiance, O.
Norton Grinding Co., Worcester, Mass.
Rockford Tool Co., Rockford, Ill.

### Balls, Brass, Steel, Etc.
Abbott Ball Co., Elmwood, Hartford, Conn.
Auburn Ball Bearing Co., 33 Elizabeth St., Rochester, N. Y.
Blum & Co., Julius, 510 W. 24th St., New York.
Frasse & Co., Inc., Peter A., 417 Canal St., New York.
Gwilliam Co., 253 W. 58th St., New York.
Rochester Ball Bearing Co., Inc., 205 State St., Rochester, N. Y.

### Bars, Boring
See Boring Bars.

### Bearings
Kingsbury, Albert, Pittsburgh, Pa.

### Bearings, Babbitt
Bond Foundry & Mch. Co., Manheim, Lancaster Co., Pa.
Erie Bronze Corp., Erie, Pa.
Legier-Eilerman Co., Dayton, O.
Link-Belt Company, Chicago, Ill.
Lumen Bearing Co., Buffalo, N. Y.
Parker White Metal & Mch. Co., Erie, Pa.
Roversford Foundry & Mch. Co., 54 N. 5th St., Philadelphia, Pa.

### Bearings, Ball
Auburn Ball Bearing Co., 33 Elizabeth St., Rochester, N. Y.
Ball & Roller Bearing Co., Danbury, Conn.
Bantam Ball Bearing Co., Bantam, Conn.
Bearings Co. of America, Lancaster, Pa.
Boston Gear Works, Norfolk Downs, Mass.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., 42 Williams St., Poughkeepsie, N. Y.
Gurney Ball Bearing Co., Jamestown, N. Y.
Gwilliam Co., 253 W. 58th St., New York.
New Departure Mfg. Co., Bristol, Conn.
Norma Co. of America, 1790 Broadway, New York.
Rochester Ball Bearing Co., Inc., 205 State St., Rochester, N. Y.
Standard Roller Bearing Co., Philadelphia, Pa.

### Bearings, Bronze
Ajax Metal Co., Philadelphia, Pa.
Besly & Co., Chas. H., 120-B North Clinton St., Chicago, Ill.
Bunting Brass & Bronze Co., 748 Spencer St., Toledo, O.
Erie Bronze Corp., Erie, Pa.
Johnson Bronze Co., New Castle, Pa.
Lumen Bearing Co., Buffalo, N. Y.

### Bearings, Lineshaft
Hyatt Roller Bearing Co., Metropolitan Tower, New York.
Roversford Foundry & Mch. Co., 54 N. 5th St., Philadelphia, Pa.

### Bearings, Oilless
Arguto Oilless Bearing Co., 145 Berkley St., Wayne Junction, Philadelphia, Pa.
Bound Broook Oilless Bearing Co., Bound Brook, N. J.

### Bearings, Ring Oiling
Cresson-Morris Co., Philadelphia, Pa.
Link-Belt Company, Chicago, Ill.

### Bearings, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Bantam Ball Bearing Co., Bantam, Conn.
Gwilliam Co., 253 W. 58th St., New York.
Hart Roller Bearing Co., Orange, N. J.
Hyatt Roller Bearing Co., Metropolitan Tower, New York.
Railway Roller Bearing Co., Syracuse, N. Y.
Roversford Foundry & Mch. Co., 54 N. 5th St., Philadelphia, Pa.

### Bearings, Thrust
Kingsbury, Albert, Pittsburgh, Pa.

### Belt Cement
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.
Schieren Co., Chas. A., 73 Ferry St., New York.

### Belt Clamps
Hoggson & Pettis Mfg. Co., New Haven, Conn.

### Belt Dressing
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Dixon Crucible Co., Joseph, Jersey City, N. J.
Graton & Knight Mfg. Co., Worcester, Mass.
Schieren Co., Chas. A., 73 Ferry St., New York.

### Belt Fasteners, Leather
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
Schieren Co., Chas. A., 73 Ferry St., New York.

### Belt Fasteners, Metal
Bristol Co., Waterbury, Conn.
Graton & Knight Mfg. Co., Worcester, Mass.
Greene, Tweed & Co., 109 Duane St., New York.
Schieren Co., Chas. A., 73 Ferry St., New York.

### Belting, Leather
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
Ladew Co., Inc., E. R., Glen Cove, N. Y.
Schieren Co., Chas. A., 73 Ferry St., New York.

### Belting, Round Leather
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### Belt Lacing
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New Britain Mch. Co., New Britain, Conn.

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### Bending Machines, Hydraulic
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
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Treadwell Engineering Co., Easton, Pa.
Watson-Stillman Co., 192 Fulton St., New York.
Williams, White & Co., Moline, Ill.

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Newman Mfg. Co., Cincinnati, O.
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Pedrick Tool & Mch. Co., 3639 N. Lawrence St., Philadelphia, Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Treadwell Engineering Co., Easton, Pa.
Underwood Corp., H. B., Philadelphia, Pa.
Watson-Stillman Co., 192 Fulton St., New York.

### Blocks, Chain
See Hoists, Etc.

### Blowers
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Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., 1154 So. Central Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

### Blowers, Positive Pressure
Leiman Bros., 62 E-2 John St., New York.

### Blueprint Drying Machines
Buckeye Engine Co., Salem, O.
Keuffel & Esser Co., Hoboken, N. J.
Paragon Machine Co., Rochester, N. Y.
Wagenhorst & Co., J. H., Youngstown, O.

### Blueprint Filing Cabinets
See Cabinets, Filing.

### Blueprint Machines
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Keuffel & Esser Co., Hoboken, N. J.
Paragon Machine Co., Rochester, N. Y.
Wagenhorst & Co., J. H., Youngstown, O.

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Paragon Machine Co., Rochester, N. Y.

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Craftsman Tool Co., Conneaut, O.
Foote-Burt Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, O.
National Mchy. Co., Tiffin, O.
Standard Engineering Co., Ellwood City, Pa.
Webster & Perks Tool Co., Springfield, O.

### Bolts and Nuts
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National Acme Co., Cleveland, O.

### Books, Technical
Industrial Press, 148 Lafayette St., New York.

### Boosters
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

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Dale-Brewster Mchy. Co., Inc., 541 W. Washington Blvd., Chicago, Ill.
Defiance Mch. Wks., Defiance, O.
Giddings & Lewis Mfg. Co., Fond du Lac, Wis.
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Foote-Burt Co., Cleveland, O.
Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis.
Moline Tool Co., Moline, Ill.
Niles-Bement-Pond Co., 111 Broadway, New York.
Pedrick Tool & Mch. Co., 3639 N. Lawrence St., Philadelphia, Pa.
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Niles-Bement-Pond Co., 111 Broadway, New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

### Boring Bars
American Hollow Boring Co., Erie, Pa.
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill.
Beaman & Smith Co., Providence, R. I.
Black & Decker Mfg. Co., 140 S. Calvert St., Baltimore, Md.
Giddings & Lewis Mfg. Co., Fond du Lac, Wis.
Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis.
Lovejoy Tool Co., Inc., Springfield, Vt.
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Pedrick Tool & Mch. Co., 3639 N. Lawrence St., Philadelphia, Pa.
Ready Tool Co., 650 Railroad Ave., Bridgeport, Conn.
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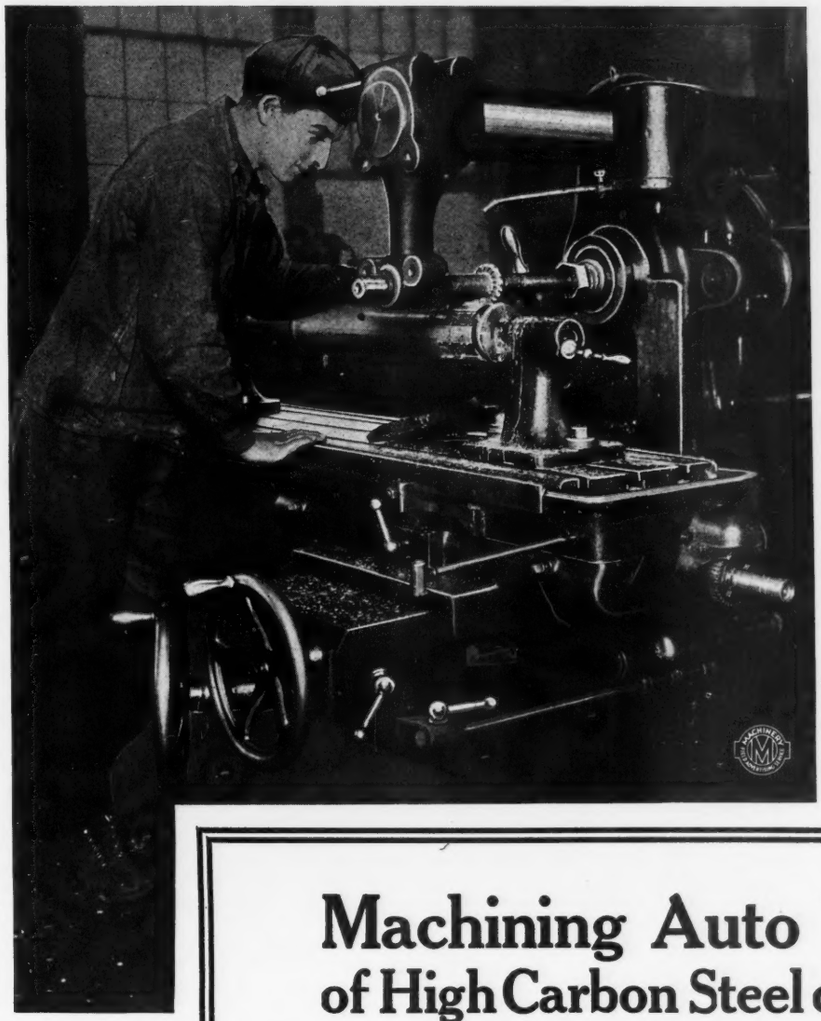

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Manufacturers Equipment Co., Waller and Fillmore Sts., Chicago, Ill.
Nelson-Blanck Mfg. Co., Detroit, Mich.
Payson Co., Frank G., 9 So. Clinton St., Chicago, Ill.

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Greenfield Tap & Die Corp., Greenfield, Mass.
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Montgomery & Co., Inc., 105 Fulton St., New York.
Newman Mfg. Co., Cincinnati, O.
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Pratt Chuck Co., Frankfort, N. Y.
Rivett Lathe & Grinder Co., Brighton District, Boston, Mass.
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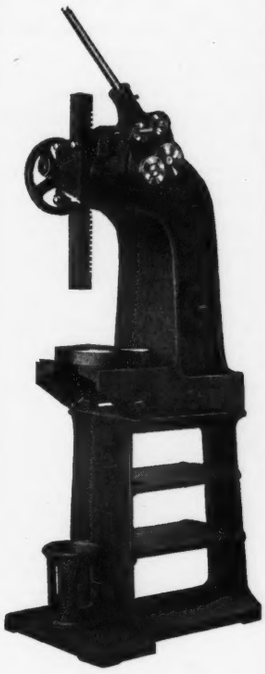

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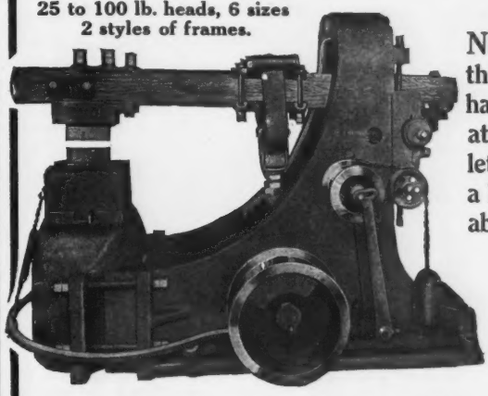

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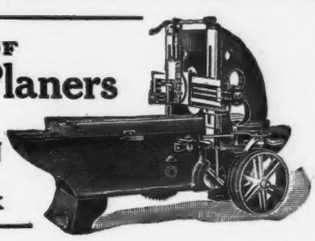

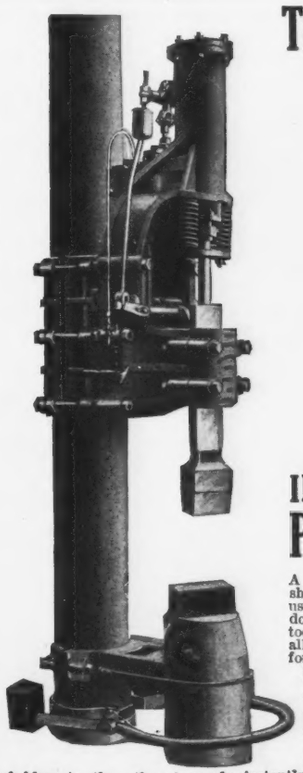

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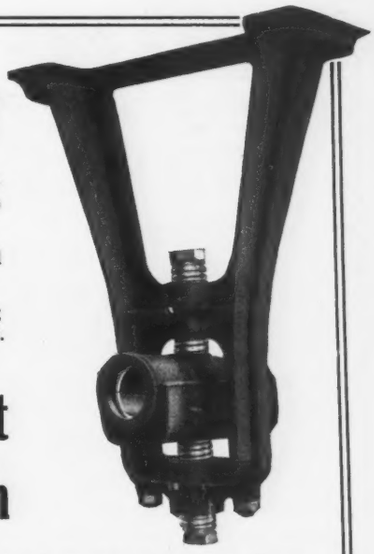

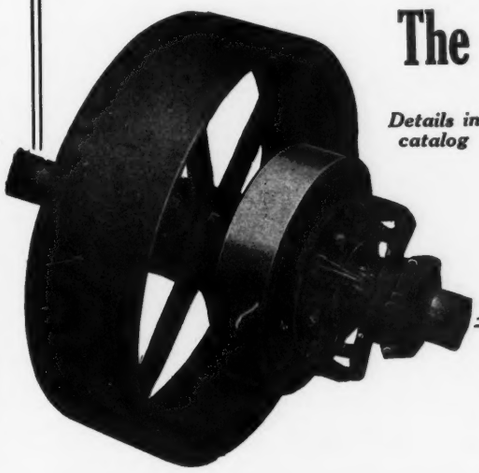

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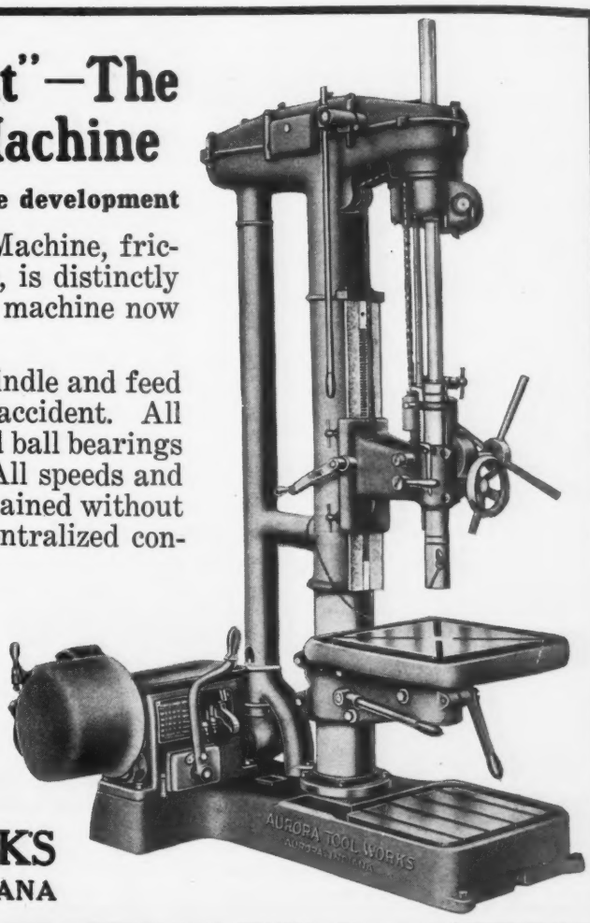


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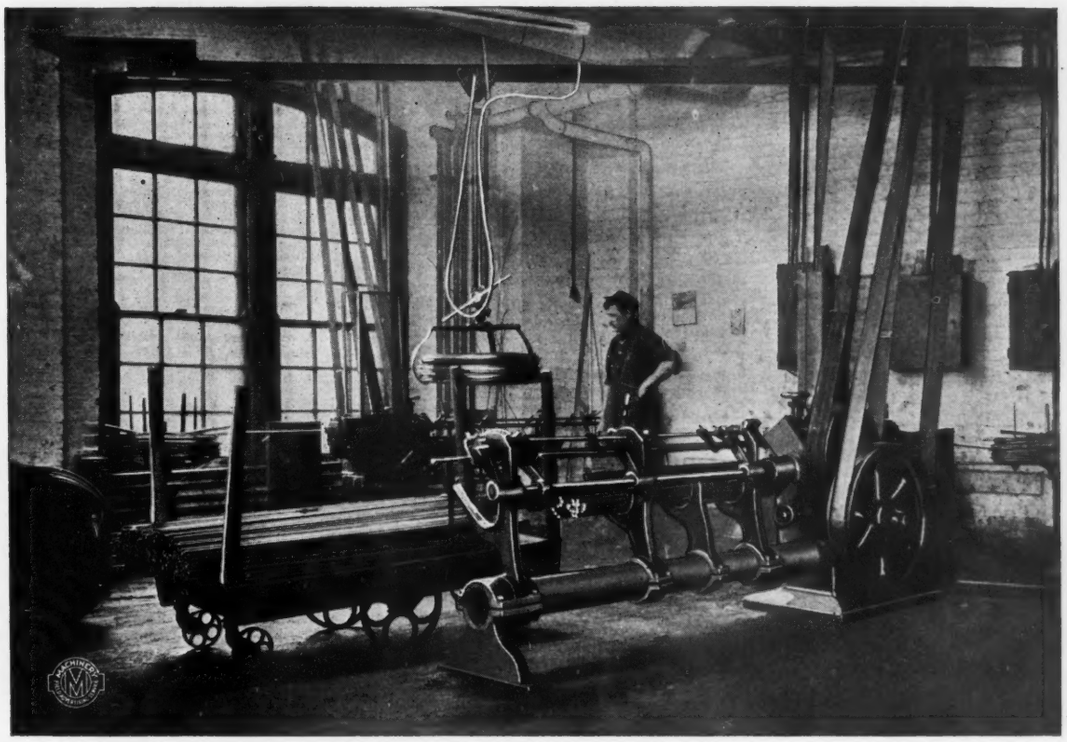
# SHUSTER MACHINES

## THAT ARE GIVING EXCELLENT SERVICE



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WHEN photographed, the smaller and older machine was cutting 1/4" wire into 25 5/8" lengths to be used in making sugar jar supports—production 10,000 per ten hour day.

The larger machine is cutting 3/8" wire, 51 13/16" long—for use in head rests for folding beds.

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Waltham Mch. Works, Waltham, Mass.

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Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Co., 2nd and State Sts., Erie, Pa.
Murchey Mch. & Tool Co., 34 Porter St., Detroit, Mich.
National Acme Co., Cleveland, O.
Rickert-Shafer Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.
Webster & Perks Tool Co., Springfield, O.

### Dividing Heads
See Milling Machines, Horizontal, Universal.
Dickow, Fred C., 1857 W. Lake St., Chicago, Ill.
Whiting & Comstock, Hartford, Conn.

### Dogs, Lathe
Billings & Spencer Co., Hartford, Conn.

### Drafting Instruments
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Paragon Machine Co., Rochester, N. Y.

### Drafting Machines
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Keuffel & Esser Co., Hoboken, N. J.
New Britain Mch. Co., New Britain, Conn.
Paragon Machine Co., Rochester, N. Y.
Universal Drafting Machine Co., Cleveland, O.

### Drawing Materials
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Calder, Geo. H., Lancaster, Pa.
Desmond-Stephan Mfg. Co., Urbana, O.
Francis & Co., Hartford, Conn.
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Machinery Co. of America, Big Rapids, Mich.
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National Grinding Wheel Co., Inc., Buffalo, N. Y.
Norton Co., Worcester, Mass.
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Standard Tool Co., Cleveland, O.
Sterling Grinding Wheel Co., Tiffin, O.
Vitrified Wheel Co., Westfield, Mass.
Western Tool & Mfg. Co., Springfield, O.

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Newman Mfg. Co., Cincinnati, O.
Nelson-Blanck Mfg. Co., Detroit, Mich.
National Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mch. Co., Rockford, Ill.
Sellew Mch. Tool Co., Pawtucket, R. I.

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Ward's Sons Co., Edgar T. Boston, Mass.

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Detroit Twist Drill Co., Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Scully-Jones & Co., 647 Railway Exchange Bldg., Chicago, Ill.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Wolverine Brass Works, Grand Rapids, Mich.

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Graham Mfg. Co., Providence, R. I.
Peter Bros. Mfg. Co., 135 Railroad Ave., Algonquin, Ill.

### Drill Stands
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Standard Tool Co., Cleveland, O.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Waterston, J. M., Detroit, Mich.

### Drilling and Milling Machines, Vertical
Cochrane-Bly Co., Rochester, N. Y.
Knight Mch. Co., W. B., St. Louis, Mo.
Moline Machinery Co., Moline, Ill.

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Baker Bros., Toledo, O.

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Ames Co., R. C., Waltham, Mass.
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Blomquist-Eck Mch. Co., Cleveland, O.
Buffalo Forge Co., Buffalo, N. Y.
Burke Mch. Tool Co., Conneaut, O.
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Pratt & Whitney Co., Hartford, Conn.
Reed Co., Francis, 43 Hammond St., Worcester, Mass.
Rockford Drilling Mch. Co., Rockford, Ill.
Taylor & Fenn Co., Hartford, Conn.
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Winterhoff Tool & Mch. Co., Elkhart, Ind.

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Defiance Mch. Wks., Defiance, O.
Harrington, Son & Co., Inc., Edwin, Philadelphia, Pa.
Foote-Burt Co., Cleveland, O.
Niles-Bement-Pond Co., 111 Broadway, New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

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Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.
Barnes Drill Co., Inc., 814 Chestnut St., Rockford, Ill.
Bilton Mch. Tool Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Oakley, Cincinnati, O.
Cincinnati Pulley Mchy. Co., Inc., Cincinnati, O.
Colburn Machine Tool Co., Franklin, Pa.
Defiance Machine Works, Defiance, O.
Foote-Burt Co., Cleveland, O.
Fosdick Machine Tool Co., Cincinnati, O.
Garvin Mch. Co., Spring and Varick Sts., New York.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
Langelier Mfg. Co., Arlington, Cranston, R. I.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Niles-Bement-Pond Co., 111 Broadway, New York.
Rockford Drilling Mch. Co., Rockford, Ill.
Silver Mfg. Co., Salem, O.

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Colburn Mch. Tool Co., Franklin, Pa.

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Langelier Mfg. Co., Arlington, Cranston, R. I.

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Defiance Mch. Wks., Defiance, O.
Harrington, Son & Co., Inc., Edwin, Philadelphia, Pa.
Langelier Mfg. Co., Arlington, Cranston, R. I.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Richmond, Ind.
Nelson-Blanck Mfg. Co., Detroit, Mich.
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Harrington, Son & Co., Inc., Edwin, Philadelphia, Pa.
Langelier Mfg. Co., Arlington, Cranston, R. I.
Moline Tool Co., Moline, Ill.
National Acme Co., Cleveland, O.
National Automatic Tool Co., Richmond, Ind.
Nelson-Blanck Mfg. Co., Detroit, Mich.

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Barnes Drill Co., Inc., 814 Chestnut St., Rockford, Ill.
Cincinnati Bickford Tool Co., Oakley, Cincinnati, O.
Cincinnati Pulley Mchy. Co., Cincinnati, O.
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Colburn Mch. Tool Co., Franklin, Pa.
Defiance Mch. Works, Defiance, O.
Foote-Burt Co., Cleveland, O.
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Langelier Mfg. Co., Arlington, Cranston, R. I.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
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Rockford Mch. Tool Co., Rockford, Ill.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Silver Mfg. Co., Salem, O.
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# SHUSTER MACHINES

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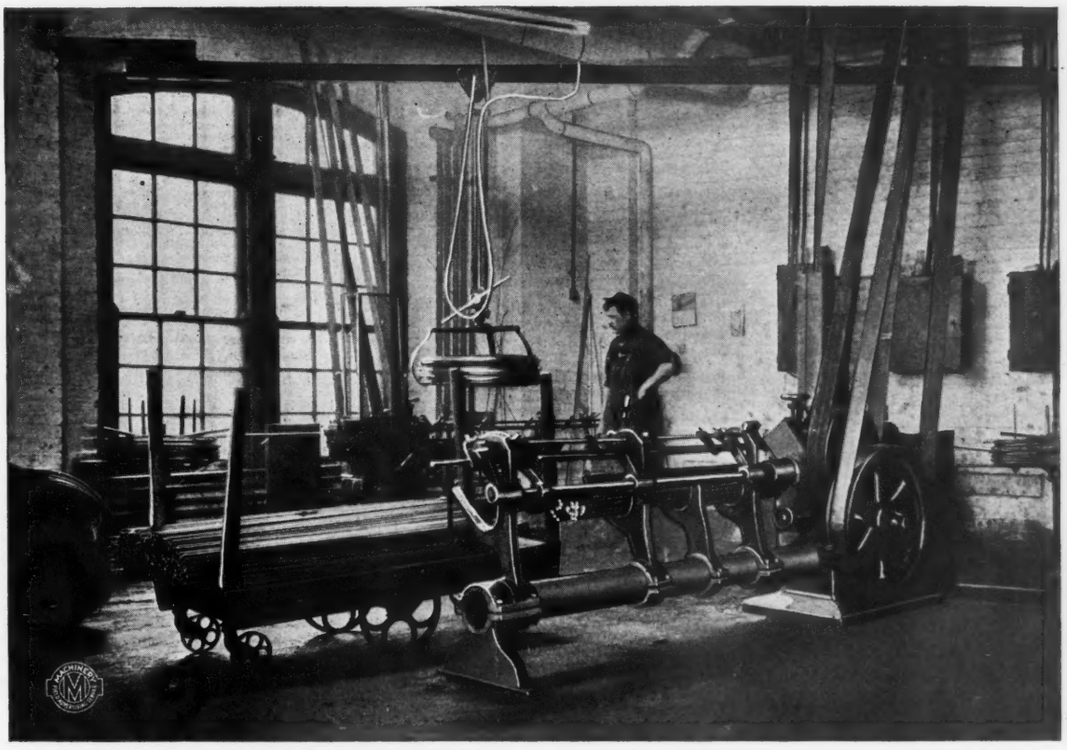

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See Dressers, Grinding Wheel.

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# BLACK DIAMOND FILE WORKS

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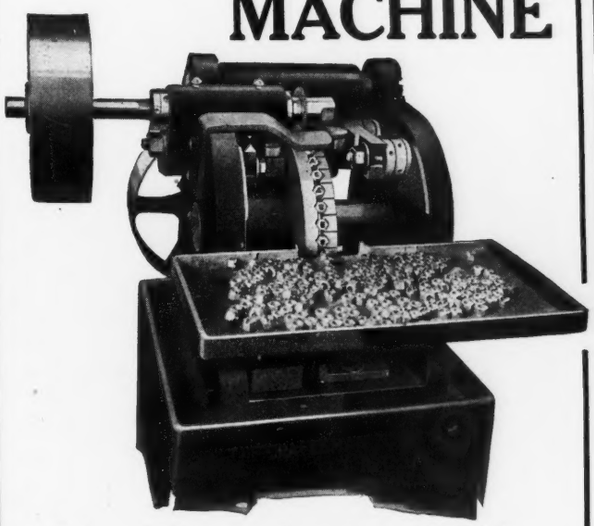

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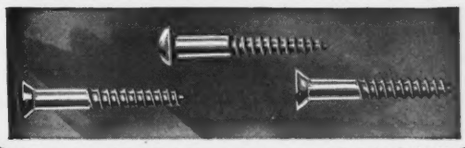

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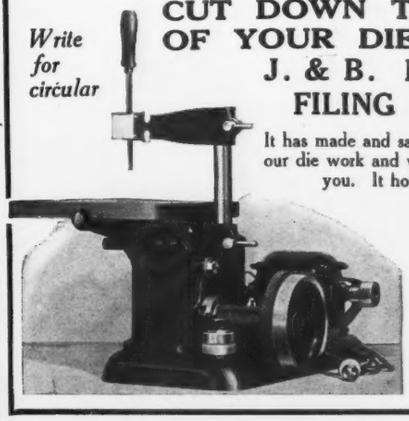

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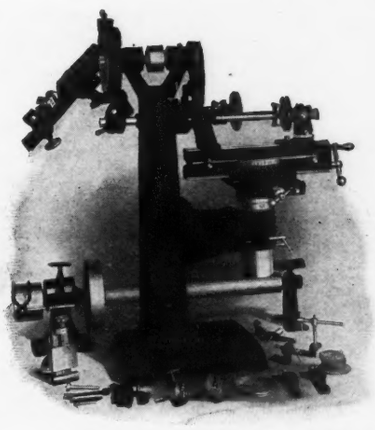

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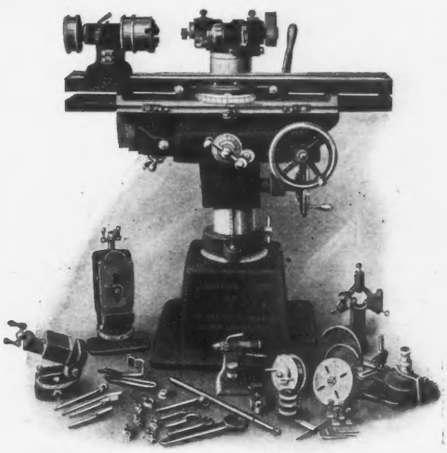

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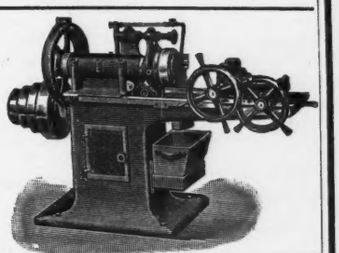

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Fraser Co., Warren F., Westboro, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Lansing Stamping & Tool Co., Lansing, Mich.
Landis Tool Co., Waynesboro, Pa.
Madison Mch. Tool Co., Madison, Wis.
Modern Tool Co., 2nd and State Sts., Erie, Pa.
Ott Grinder Co., Indianapolis, Ind.
Rivett Lathe & Grinder Co., Brighton, Boston, Mass.
United States Electrical Tool Co., 6th Ave. and Mt. Hope St., Cincinnati, O.
Universal Grinding Mch. Co., Fitchburg, Mass.
Van Norman Machine Tool Co., Waltham Ave., Springfield, Mass.
Wilmarth & Morman Co., 1180 Monroe Ave., N. W., Grand Rapids, Mich.
Woods Engineering Co., Alliance, O.

**Grinding Machines, Knife**
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Defiance Mch. Wks., Defiance, O.
Diamond Mch. Co., Providence, R. I.

**Grinding Machines, Motor-Driven, Non-Portable**
Forbes & Myers, 178 Union St., Worcester, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Hawes, C. L., Ashtabula, O.
Ransom Mfg. Co., Oshkosh, Wis.
Webster & Perks Tool Co., Springfield, O.

**Grinding Machines, Multiple Spindle**
Bryant Chucking Grinder Co., Springfield, Vt.

**Grinding Machines, Pipe Threading Die**
Bignall & Keeler Mch. Works, Edwardsville, Ill.
Landis Tool Co., Waynesboro, Pa.
National Mchy. Co., Tiffin, O.

**Grinding Machines, Piston Ring**
Bristol Machine Tool Co., Bristol, Conn.
Heald Machine Co., Worcester, Mass.
Machinery Co. of America, Big Rapids, Mich.
Pedrick Tool & Mch. Co., 3639 N. Lawrence St., Philadelphia, Pa.
Persons-Arter Mch. Co., Worcester, Mass.
Walker Co., O. S., Worcester, Mass.

**Grinding Machines, Portable Electric**
Cincinnati Electrical Tool Co., Cincinnati, O.
Clark Elec. Co., Inc., Jas. R., Louisville, Ky.
General Electric Co., Schenectady, N. Y.
Haskins, R. G., 547 W. Washington Blvd., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
National Mch. Tool Co., Racine, Wis.
Neil & Smith Elec. Tool Co., Cincinnati, O.
Saphil Mfg. Corp., 141 W. Austin Ave., Chicago, Ill.
Stow Mfg. Co., Binghamton, N. Y.
United States Electrical Tool Co., 6th Ave. and Mt. Hope St., Cincinnati, O.
Van Dorn Electric Co., Cleveland, O.
Wisconsin Electric Co., Racine, Wis.

**Grinding Machines, Profile**
Fischer Machine Co., Philadelphia, Pa.

**Grinding Machines, Radial, Ball Race, Etc.**
Rivett Lathe & Grinder Co., Brighton, Boston, Mass.
Van Norman Machine Tool Co., Waltham Ave., Springfield, Mass.

**Grinding Machines, Rotary Surface**
Bristol Machine Tool Co., Bristol, Conn.
Heald Machine Co., Worcester, Mass.
Persons-Arter Co., Worcester, Mass.

**Grinding Machines, Surface**
Abrasive Mch. Tool Co., East Providence, R. I.
Blake & Johnson Co., Waterbury, Conn.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cady Co., Inc., O. N., Canastota, N. Y.
Diamond Machine Co., Providence, R. I.
Fraser Co., Warren F., Westboro, Mass.
Garvin Mch. Co., Spring and Varick Sts., New York.
Heald Machine Co., Worcester, Mass.
Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Noble & Westbrook Mfg. Co., Hartford, Conn.
Norton Grinding Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Reed-Prentice Co., F. E. Reed Dept. and Prentice Bros. Dept., Worcester, Mass.
Reid Bros. Co., Inc., Beverly, Mass.
Rowbottom Machine Co., Waterbury, Conn.
Saphil Mfg. Corp., 141 W. Austin Ave., Chicago, Ill.
Universal Grinding Mch. Co., Fitchburg, Mass.
Walker Co., O. S., Worcester, Mass.
Wilmarth & Morman Co., 1180 Monroe Ave., N. W., Grand Rapids, Mich.
Woods Engineering Co., Alliance, O.

**Grinding Machines, Thread**
Blair Tool & Mch. Works, 521 Greenwich St., New York.
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.

**Grinding Machines, Tool and Cutter**
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill.
Baird Mch. Co., Bridgeport, Conn.
Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.
Blake & Johnson Co., Waterbury, Conn.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Elec. Tool Co., Cincinnati, O.
Cincinnati Milling Mch. Co., Oakley, Cincinnati, O.
Diamond Machine Co., Providence, R. I.
Factory & Mill Supply Co., Boston, Mass.
Fenn Mfg. Co., Hartford, Conn.
Forbes & Myers, 178 Union St., Worcester, Mass.
Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis.
Grand Rapids Grinding Machine Co., Grand Rapids, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
LeBlond Mch. Tool Co., R. K., Cincinnati, O.
Machinery Co. of America, Big Rapids, Mich.
McDonough Mfg. Co., Eau Claire, Wis.
Meisselbach-Catucci Mfg. Co., 27 Congress St., Newark, N. J.
Modern Tool Co., 2nd and State Sts., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, O.
Norton Grinding Co., Worcester, Mass.
Oakley Mch. Tool Co., Cincinnati, O.
Oesterlein Mch. Tool Co., Cincinnati, O.
Ott Grinder Co., Indianapolis, Ind.
Royersford Fdry. & Mch. Co., 54 N. 5th St., Philadelphia, Pa.
Saphil Mfg. Corp., 141 W. Austin Ave., Chicago, Ill.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Simmons Mch. Co., Inc., Albany, N. Y.
Standard Tool Co., Cleveland, O.
Taylor & Fenn Co., Hartford, Conn.
United States Electrical Tool Co., 6th Ave. and Mt. Hope St., Cincinnati, O.
Universal Grinding Mch. Co., Fitchburg, Mass.
Vitrified Wheel Co., Westfield, Mass.
Walker Co., O. S., Worcester, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., 1180 Monroe Ave., N. W., Grand Rapids, Mich.
Wisconsin Elec. Co., Racine, Wis.
Woods Engineering Co., Alliance, O.

**Grinding Machines, Universal**
Greenfield Tap & Die Corp., Greenfield, Mass.
Oakley Mch. Tool Co., Oakley, Cincinnati, O.
Woods Engineering Co., Alliance, O.

**Grinding Machines, Universal, Lathe and Planer Tools**
Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

**Grinding Machines, Valve**
Defiance Mch. Wks., Defiance, O.

**Grinding Wheels**
Abrasive Co., Bridesburg, Philadelphia, Pa.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Carborundum Co., Niagara Falls, N. Y.
Detroit Grinding Wheel Co., Detroit, Mich.
Hampden Carborundum Wheel Co., Springfield, Mass.
Maxf Grinding Wheel Corporation, Chester, Mass.
National Grinding Wheel Co., Inc., Buffalo, N. Y.
Norton Co., Worcester, Mass.
Star Corundum Wheel Co., Detroit, Mich.
Sterling Grinding Wheel Co., Tiffin, O.
Vitrified Wheel Co., Westfield, Mass.

**Grooving Machines, Bearing Oil**
Fischer Machine Co., Philadelphia, Pa.

**Guards for Machinery**
New Britain Mch. Co., New Britain, Conn.
Page Steel & Wire Co., Adrian, Mich.

**Gun Boring Machines**
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.

**Guns, Grease and Oil**
Royersford Foundry & Mch. Co., 54 N. 5th St., Philadelphia, Pa.

**Hammers, Helve**
High Speed Hammer Co., Rochester, N. Y.

**Hammers, Drop**
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., 17 Adams St., Brooklyn, N. Y.
Chambersburg Engineering Co., Chambersburg, Pa.
Miner & Peck Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., 111 Broadway, New York.
Toledo Mch. & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.

**Hammers, Machinists' Hand**
Billings & Spencer Co., Hartford, Conn.
Pannier Bros. Stamp Co., Inc., Pittsburgh, Pa.

**Hammers, Pneumatic**
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York.
Nazel Engineering Works, 4043 N. 5th St., Philadelphia, Pa.
Q M S Co., 1763 Elston Ave., Chicago, Ill.

**Hammers, Power**
Beaudry & Co., Inc., Boston, Mass.
Bradley & Son, Inc., C. C., Syracuse, N. Y.
Dienelt & Eisenhardt, Inc., Philadelphia, Pa.
High Speed Hammer Co., Rochester, N. Y.
Little Giant Co., 131 Rock St., Mankato, Minn.
Nazel Engineering Works, 4043 N. 5th St., Philadelphia, Pa.
United Hammer Co., Oliver Bldg., Boston, Mass.
West Tire Setter Co., Rochester, N. Y.
Williams, White & Co., Moline, Ill.

**Hammers, Rawhide**
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.

**Hammers, Shell Nosing**
Beaudry & Co., Inc., Boston, Mass.
Nazel Engineering Works, 4043 N. 5th St., Philadelphia, Pa.

**Hammers, Steam**
Chambersburg Engineering Co., Chambersburg, Pa.
Niles-Bement-Pond Co., 111 Broadway, New York.
Q M S Co., 1763 Elston Ave., Chicago, Ill.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

**Handles, Machine**
Cincinnati Ball Crank Co., Cincinnati, O.

**Hangers, Shaft**
Bond Foundry & Mch. Co., Manheim, Lancaster Co., Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Brown Co., A. & F., 79 Barclay St., New York.
Cresson-Morris Co., Philadelphia, Pa.
Defiance Mch. Works, Defiance, O.
Fafnir Bearing Co., New Britain, Conn.
Woods Sons Co., T. B., Chambersburg, Pa.
Link-Belt Company, Chicago, Ill.
New Departure Mfg. Co., Bristol, Conn.
Royersford Fdry. & Mch. Co., 54 N. 5th St., Philadelphia, Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Standard Pressed Steel Co., Philadelphia, Pa.

**Hardness Testing Instruments**
Shore Instrument & Mfg. Co., Inc., 557 W. 22nd St., New York.

**Heading Machines, Cold**
Cook Co., Asa S., Hartford, Conn.

**Heating and Ventilating Apparatus**
Buffalo Forge Co., Buffalo, N. Y.
Canton Art Metal Co., Canton, O.

**Heat Treatment of Steel**
Steel Improvement & Forge Co., Cleveland, O.

**Hobbing Machines**
See Gear Cutting Machines, Helical and Spur (Hob) and Gear Cutting Machines, Worms and Worm Wheels (Hob).

**Hobs**
Adams Co., Dubuque, Iowa.
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Detroit Reamer & Tool Co., Detroit, Mich.
Goddard Tool Co., Chicago, Ill.
Gould & Eberhardt, Newark, N. J.
Illinois Tool Works, Chicago, Ill.
Lees-Bradner Co., Cleveland, O.
Meisselbach-Catucci Mfg. Co., 27 Congress St., Newark, N. J.

Michigan Tool Co., Detroit, Mich.
Newark Gear Cutting Mch. Co., Newark, N. J.
Superior Machine & Engineering Co., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.

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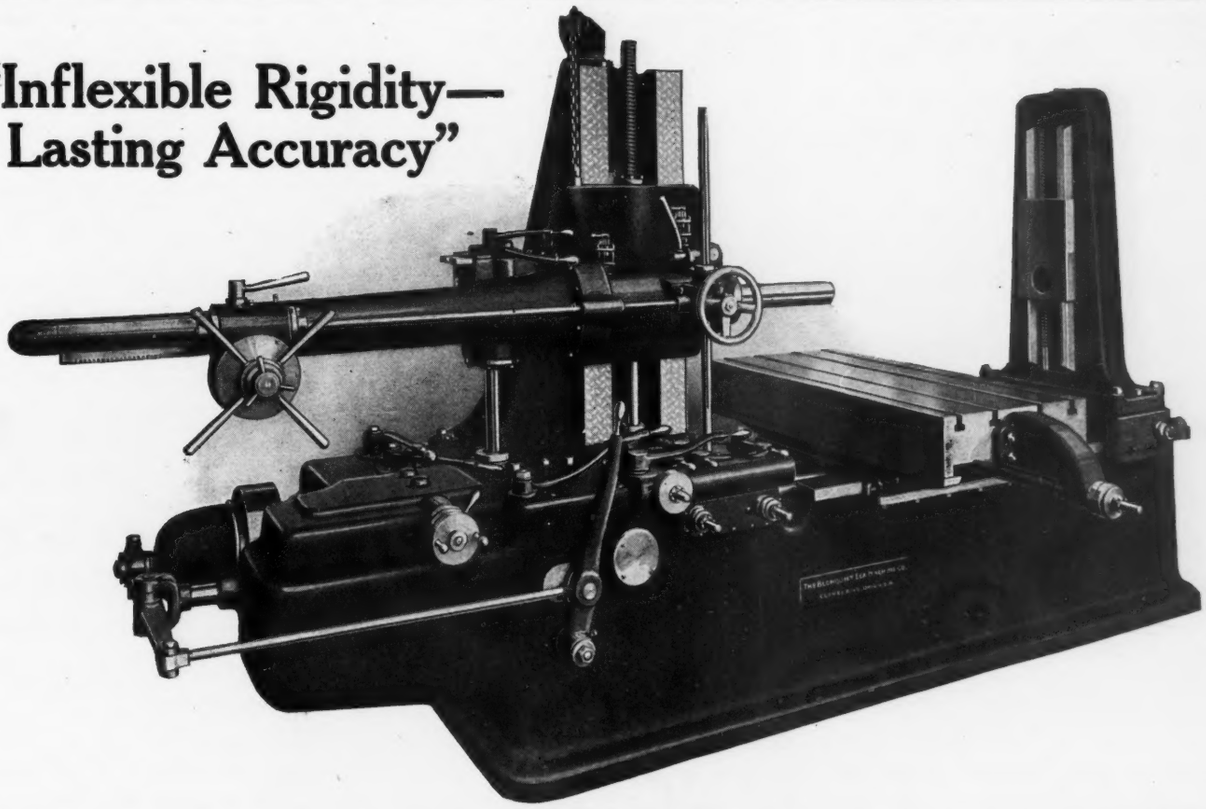
"Inflexible Rigidity—
Lasting Accuracy"

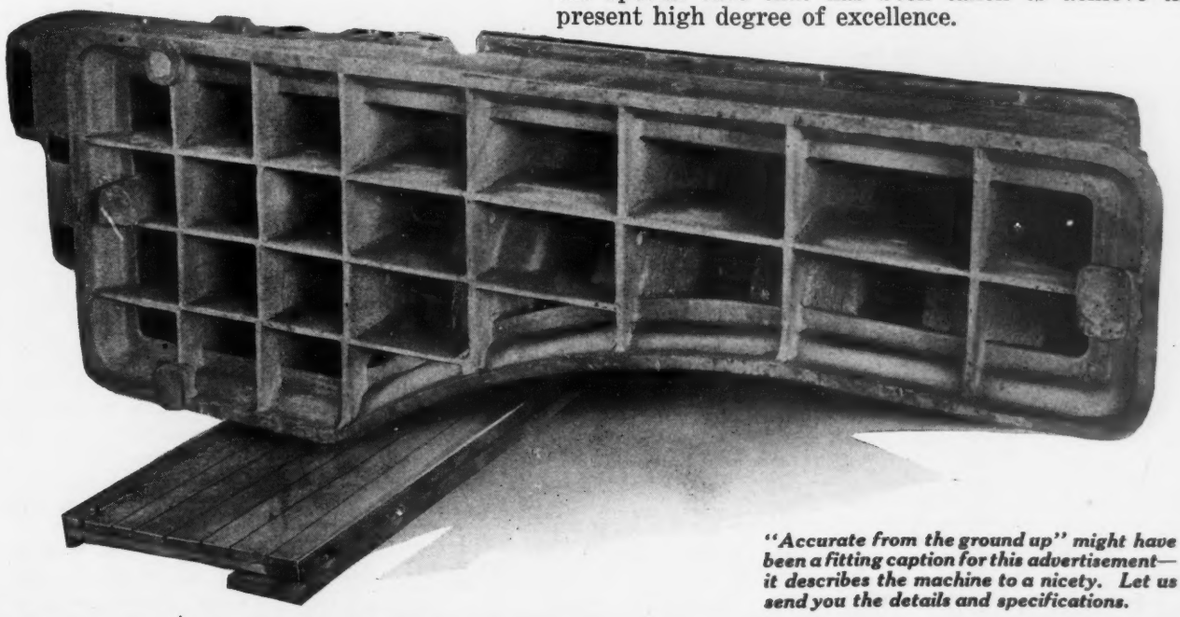


# THE BLOMQUIST-ECK

## BORING, MILLING AND DRILLING MACHINE

*A Rigid Foundation Upon Which to Build*

The lower photograph shows the rigid foundation which is such an important contributing factor to the remarkable accuracy of these machines. Just as this base is unusual in its construction and careful reinforcement—so the entire machine gives evidence of the special care that has been taken to achieve the present high degree of excellence.



***"Accurate from the ground up" might have been a fitting caption for this advertisement—it describes the machine to a nicety. Let us send you the details and specifications.***

## THE BLOMQUIST-ECK MACHINE COMPANY

**1146 EAST 152nd STREET** **CLEVELAND, OHIO, U. S. A.**

AGENTS: The Strong, Carlisle & Hammond Co., Cleveland, O., and Detroit, Mich. The Federal Machinery Sales Co., Chicago Ill., and Milwaukee, Wis. Vandyck Churchill Company, New York City, N. Y. Ogden R. Adams, Rochester, N. Y. W. E. Shipley Machinery Co., Philadelphia, Pa. Brown & Zortman Machinery Co., Pittsburgh, Pa. Patterson Tool & Supply Co., Dayton, O. Fulton Supply Co., Atlanta, Ga. F. E. Satterlee Co., Minneapolis, Minn. Herberts Machinery & Supply Co., Los Angeles, Cal. FOREIGN AGENTS: Gaston, Williams & Wigmore, Inc., France, Italy, Belgium and Japan. Nielsen & Winther, Ltd., Norway, Sweden and Denmark. Buck & Hickman, United Kingdom of Great Britain. Garlock-Walker Machinery Co., Toronto, Canada.

**Hoists, Air**
Ingersoll-Rand Co., 11 Broadway, New York.
Northern Engineering Works, Detroit, Mich.
Q M S Co., 1763 Elston Ave., Chicago, Ill.

**Hoists, Chain, Etc.**
Box & Co., Inc., Alfred, Philadelphia, Pa.
Chisholm-Moore Mfg. Co., Cleveland, O.
Ford Chain Block & Mfg. Co., Philadelphia, Pa.
Harrington, Son & Co., Inc., Edwin, Philadelphia, Pa.
Niles-Bement-Pond Co., 111 Broadway, New York.
Wright Mfg. Co., Lisbon, O.
Yale & Towne Mfg. Co., 9 E. 40th St., New York.

**Hoists, Electric**
Armington Engineering Co., Euclid, O.
Box & Co., Inc., Alfred, Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Link-Belt Company, Chicago, Ill.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Shepard Electric Crane & Hoist Co., Montour Falls, New York.
Thomas Elevator Co., 28 S. Hoyne Ave., Chicago, Ill.
Toledo Bridge & Crane Co., Toledo, O.
Yale & Towne Mfg. Co., 9 E. 40th St., New York.

**Hoists, Pneumatic**
Curtis Pneumatic Mchy. Co., 1568 Kienlen Ave., St. Louis, Mo.
Northern Engineering Works, Detroit, Mich.
Ingersoll-Rand Co., 11 Broadway, New York.
Q M S Co., 1763 Elston Ave., Chicago, Ill.
Shepard Electric Crane & Hoist Co., Montour Falls, New York.

**Hoists, Portable**
Canton Foundry & Machine Co., Canton, O.

**Horses, Steel**
Frasse & Co., Inc., Peter A., 417 Canal St., New York.

**Hydraulic Machinery and Tools**
Chambersburg Engineering Co., Chambersburg, Pa.
Elmes Engineering Works, Chas. F., 222 N. Morgan St., Chicago, Ill.
Hydraulic Press Mfg. Co., 84 Lincoln Ave., Mt. Gilead, O.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., 111 Broadway, New York.
Watson-Stillman Co., 192 Fulton St., New York.
Williams, White & Co., Moline, Ill.

**Hydrogen**
Air Reduction Co., Inc., 120 Broadway, New York.
International Oxygen Co., Newark, N. J.

**Hydrometers**
Brown Instrument Co., Philadelphia, Pa.
Taylor Instrument Companies, Rochester, N. Y.

**Index Centers**
See Milling Machines, Horizontal, Universal.
Abrasive Mch. Tool Co., East Providence, R. I.
Carroll & Son, Wm., Cincinnati, O.
Dickow, Fred C., 35 So. Desplaines St., Chicago, Ill.
Simmons Mch. Co., Inc., Albany, N. Y.

**Indicators, Speed**
Brown & Sharpe Mfg. Co., Providence, R. I.
Brown Instrument Co., Philadelphia, Pa.
Greene, Tweed & Co., 109 Duane St., New York.
Johnson & Miller, 42 Murray St., New York.
Starrett Co., L. S., Athol, Mass.
Veeder Mfg. Co., 39 Sargeant St., Hartford, Conn.

**Indicators, Test**
American Gauge Co., Dayton, O.
Bath & Co., Inc., John, Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Brown Instrument Co., Philadelphia, Pa.
Fisher-Smith Co., Dayton, O.
Johnson & Miller, 42 Murray St., New York.
Norton Grinding Co., Worcester, Mass.
Starrett Co., L. S., Athol, Mass.

**Injectors, Steam**
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Walworth Mfg. Co., Boston, Mass.

**Jacks, Hydraulic**
Watson-Stillman Co., 192 Fulton St., New York.

**Jacks, Planer**
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill.

**Jigs and Fixtures**
American Tool & Mfg. Co., Urbana, O.
Anderson Mfg. Co., Elyria, O.
Arrow Tool Co., Bridgeport, Conn.
Becker Milling Machine Co., Hyde Park, Mass.
Black & Decker Mfg. Co., 140 S. Calvert St., Baltimore, Md.
Columbus Die, Tool & Mch. Co., Columbus, O.
Crawford Tool & Mfg. Co., 1617 So. Crawford Ave., Chicago, Ill.
Craftsman Tool Co., Conneaut, O.
Davie Tool Co., Cleveland, O.
Davis Mch. Co., Inc., C. F., Rochester, N. Y.
Detroit Reamer & Tool Co., Detroit, Mich.
Fenn Mfg. Co., Hartford, Conn.
Garrison Machine Works, Dayton, O.
Gem City Mch. Co., Dayton, O.
Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis.
Globe Mch. & Stamping Co., Cleveland, O.
Goddard Tool Co., Chicago, Ill.
Harris Engineering Co., H. E., Bridgeport, Conn.
Johansson, Inc., C. E., 245 W. 55th St., New York.
Krasberg Engineering & Mfg. Corp., 536 Lake Shore Drive, Chicago, Ill.
Lansing Stamping & Tool Co., Lansing, Mich.
Liberty Systems Corp., St. Louis, Mo.
Lowry-Knise Tool Co., Inc., Syracuse, N. Y.
Marvin & Casler Co., Canastota, N. Y.
Mehl Mch. Tool & Die Co., Roselle, N. J.
Meyers Gage Co., W. F., Bedford, Ind.
Michigan Tool Co., Detroit, Mich.
Modern Tool & Mch. Works, Inc., Newark, N. J.
Modern Tool, Die & Machine Co., Columbus, O.
Moline Machinery Co., Moline, Ill.
Moore-Eastwood Mfg. Co., Dayton, O.
Nelm Tool Co., Inc., 781-783 E. 142nd St., New York.
Potter Tool & Mch. Works, S. A., 77 E. 130th St., New York.
Reliance Die & Stamping Co., 515 N. La Salle St., Chicago, Ill.
S-P Manufacturing Co., Cleveland O.
Steel Products Engineering Co. Springfield, O.
Superior Machine & Engineering Co., Detroit, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Taylor-Shantz Co., Rochester, N. Y.
Urbana Tool & Die Co., Urbana, O.
Wilcox Motor & Mfg. Co., Saginaw, Mich.
Windau Tool Co., Cleveland, O.

**Kettles, Soda**
Brown & Sharpe Mfg. Co., Providence, R. I.
Gray & Prior Mch. Co., Hartford, Conn.
Niles-Bement-Pond Co., 111 Broadway, New York.

**Keyseaters**
Baker Bros., Toledo, O.
Defiance Mch. Works, Defiance, O.
Lapointe Mch. Tool Co., Hudson, Mass.
Lapointe Mfg. Co., V. E., Manchester, Conn.
Mitts & Merrill, 843 Water St., Saginaw, Mich.
Morton Mfg. Co., Muskegon Heights, Mich.
Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., 111 Broadway, New York.

**Keyseaters, Cutters for**
Davis Mch. Co., C. F., Rochester, N. Y.

**Keyseaters, Portable**
Bucher-Smith Co., East Liverpool, O.
Burr & Son, J. T., Brooklyn, N. Y.

**Keys, Machine**
Moltrup Steel Products Co., Beaver Falls, Pa.
Morton Mfg. Co., Muskegon Heights, Mich.
Standard Gauge Steel Co., Beaver Falls, Pa.
Whitman & Barnes Mfg. Co., Akron, O.
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., 61 Richards St., Brooklyn, N. Y.

**Knives, Machine**
Coes Wrench Co., Worcester, Mass.
Simonds Mfg. Co., Fitchburg, Mass.

**Knurl Holders**
Graham Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

**Knurling Tools**
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill.
Goodell-Pratt Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Co., Hartford, Conn.
Williams & Co., J. H., 61 Richards St., Brooklyn, N. Y.

**Knurling Tool Holders, Hand**
Alert Tool Co., Philadelphia, Pa.

**Ladders, Permanent**
New Britain Mch. Co., New Britain, Conn.

**Lamp Guards, Etc.**
McCrosky Tool Corp., Meadville, Pa.

**Lamps, Electric**
General Electric Co., Schenectady, N. Y.

**Lapping Machines, Power**
Builders Iron Foundry, Providence, R. I.
Niles-Bement-Pond Co., 111 Broadway, New York.
Potter Tool & Machine Works, S. A., 77 E. 130th St., New York.

**Lathe Attachments**
American Tool Works Co., Cincinnati, O.
Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.
Barnes Drill Co., Inc., 814 Chestnut St., Rockford, Ill.
Boye & Emmes Mch. Tool Co., Cincinnati, O.
Bradford Mch. Tool Co., Cincinnati, O.
Carroll-Jamieson Mch. Tool Co., 257 Davis St., Batavia, O.
Champion Tool Works Co., 4955 Spring Grove Ave., Cincinanti, O.
Chard Lathe Co., Newcastle, Ind.
Cisco Machine Tool Co., Cincinnati, O.
Diamond Mch. Co., Providence, R. I.
Flather & Co., Inc., Nashua, N. H.
Garvin Mch. Co., Spring and Varick Sts., New York.
Greaves-Klusman Tool Co., Cincinnati, O.
Davis Mch. Tool Co., Inc., Rochester, N. Y.
Fischer Mch. Co., Philadelphia, Pa.
Fitchburg Mch. Works, Fitchburg, Mass.
Hendey Mch. Co., Torrington, Conn.
LeBlond Mch. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York.
Monarch Mch. Tool Co., Sidney, O.
Mueller Mch. Tool Co., Cincinnati, O.
Newman Mfg. Co., Cincinnati, O.
Niles-Bement-Pond Co., 111 Broadway, New York.
Oliver Machinery Co., Grand Rapids, Mich.
Porter-Cable Mch. Co., Syracuse, N. Y.
Reed-Prentice Co., F. E. Reed Dept. and Prentice Bros. Dept., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder Co., Brighton, Boston, Mass.
Rockford Tool Co., Rockford, Ill.
Sebastian Lathe Co., Cincinnati, O.
Seneca Falls Mfg. Co., Inc., 381 Fall St., Seneca Falls, N. Y.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
Vandyck Churchill Co., 149 Broadway, New York.
Willard Mch. Tool Co., Cincinnati, O.

**Lathe Dogs**
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill.
Hammacher, Schlemmer & Co., 4th Ave. and 13th St., New York.
Ready Tool Co., 650 Railroad Ave., Bridgeport, Conn.
Western Tool & Mfg. Co., Springfield, O.
Williams & Co., J. H., 61 Richards Ave., Brooklyn, N. Y.

**Lathe, Planer and Shaper Tools**
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill.
Chard Lathe Co., Newcastle, Ind.
Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis.
Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Reamer Corp., Meadville, Pa.
O. K. Tool Holder Co., Shelton, Conn.
Pratt & Whitney Co., Hartford, Conn.
Ready Tool Co., 650 Railroad Ave., Bridgeport, Conn.
Sebastian Lathe Co., Cincinnati, O.
Thompson & Son Co., Henry G., New Haven, Conn.
West Haven Mfg. Co., New Haven, Conn.
Western Tool & Mfg. Co., Springfield, O.
Williams & Co., J. H., 61 Richards St., Brooklyn, N. Y.

**Lathes, Automatic**
Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., Cleveland, O.
New Britain Mch. Co., New Britain, Conn.
Potter & Johnston Mch. Co., Pawtucket, R. I.
P. W. V. Automatic Mch. Corp., Fitchburg, Mass.
Reed-Prentice Co., F. E. Reed Dept. and Prentice Bros. Dept., Worcester, Mass.

**Lathes, Automatic Screw Threading**
Automatic Machine Co., Bridgeport, Conn.

**Lathes, Axle**
Bridgeford Mch. Tool Works, 151 Winton Road, Rochester, N. Y.
Fitchburg Machine Works, Fitchburg, Mass.
Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York.
Niles-Bement-Pond Co., 111 Broadway, New York.
Sellers & Co., Inc., Philadelphia, Pa.

**Lathes, Bench**
Ames Co., B. C., Waltham, Mass.
Dalton Manufacturing Corporation, 1915 Park Ave., New York.
Diamond Mch. Co., Providence, R. I.
Elgin Tool Works, Elgin, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Bros., Inc., Berteau and Ravenswood Aves., Chicago, Ill.
Hjorth Lathe & Tool Co., Boston, Mass.
Potter Tool & Mch. Works, S. A., 77 E. 130th St., New York.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder Co., Brighton, Boston, Mass.
Seneca Falls Mfg. Co., Inc., 381 Fall St., Seneca Falls, N. Y.
Shepard Lathe Co., Cincinnati, O.
Sloan & Chace Mfg. Co., Ltd., Newark, N. J.
Van Norman Mch. Tool Co., Springfield, Mass.

**Lathes, Boring**
Bridgeford Mch. Tool Works, 151 Winton Road, Rochester, N. Y.
Gisholt Mch. Co., Madison, Wis.
Niles-Bement-Pond Co., 111 Broadway, New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

**Lathes, Brass Workers'**
Acme Machine Tool Co., Cincinnati, O.
Bardons & Oliver, Cleveland, O.
Dreses Machine Tool Co., Cincinnati, O.
Garvin Mch. Co., Spring and Varick Sts., New York.
Seneca Falls Mfg. Co., 381 Fall St., Seneca Falls, N. Y.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mch. Co., Brazil, Ind.

**Lathes, Car Wheel**
Bridgeford Mch. Tool Works, 151 Winton Road, Rochester, N. Y.
Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York.
Niles-Bement-Pond Co., 111 Broadway, New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

**Lathes, Crankshaft**
American Tool Works Co., Cincinnati, O.
Bridgeford Mch. Tool Works, 151 Winton Road, Rochester, N. Y.
LeBlond Mch. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
Niles-Bement-Pond Co., 111 Broadway, New York.

**Lathes, Engine**
Adams Mfg. Co., O. B., Rochester, N. Y. 12".
American Tool Works Co., Cincinnati, O. 14" to 24", inclusive.
Barnes Co., W. F. & John, Rockford, Ill. 9" to 18", inclusive.
Barnes Drill Co., Rockford, Ill. 14-24" and 22-36" gap.
Boye & Emmes Mch. Tool Co., Cincinnati, O. 18" to 48", inclusive.
Bradford Mch. Tool Co., Cincinnati, O. 14" to 42", inclusive.
Bridgeford Mch. Tool Works, 151 Winton Road, Rochester, N. Y. 26" to 60", inclusive.
Carroll-Jamieson Mch. Tool Co., 257 Davis St., Batavia, O. 13" and 14".
Champion Tool Works Co., 4955 Spring Grove Ave., Cincinnati, O. 12" to 18", inclusive.
Chard Lathe Co., Newcastle, Ind. 16" to 28", inclusive.
Cincinnati Lathe & Tool Co., Oakley, Cincinnati, O.
Cisco Mch. Tool Co., Cincinnati, O. 14" to 24", inclusive.
Crawford Machine Tool Co., Inc., 21 Park Row, New York. 15" to 25".
Dalton Manufacturing Corporation, 1911 Park Ave., New York. 6" to 18", inclusive.
Davis Mch. Co., Inc., C. F., Rochester, N. Y. 11".
Davis Mch. Tool Co., Inc., Rochester, N. Y. 12" to 42", inclusive.
Earle Gear & Mch. Co., Philadelphia, Pa. 14" and 18".
Flather & Co., Inc., Nashua, N. H. 13" to 26", inclusive.
Flather Mfg. Co., ashua, N. H. 7", 18".
Giddings & Lewis Mfg. Co., Fond du Lac, Wis. 15" 16" and 18".
Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis. 16" and 25".
Greaves-Klusman Tool Co., Cincinnati, O. 16" to 30".
Hamilton Mch. Tool Co., Hamilton, O. 14" to 24".
Hardinge Bros., Inc., Berteau and Ravenswood Aves., Chicago, Ill.
Hendey Mch. Co., Torrington, Conn. 12" to 24".
Hill, Clarke & Co., Inc., Boston, Mass. 18" to 30", inclusive.
Houston, Stanwood & Gamble Co., Cincinnati, O. 36" to 72", inclusive.
LeBlond Mch. Tool Co., R. K., Cincinnati, O. 12" to 36".
Lehmann Mch. Co., 514 S. Broadway, St. Louis, Mo. 16" and 18".
Lodge & Shipley Mch. Tool Co., Cincinnati, O. 14" to 48", inclusive.
Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York. 12" to 84", inclusive.
Monarch Mch. Tool Co., Sidney, O. 10" to 30".
Morris Mch. Tool Co., Cincinnati, O. 16" to 21", inclusive.
Mueller Machine Tool Co., Cincinnati, O. 18".
National Lathe Co., Cincinnati, O. 16", 17", 18", 22" and 24".

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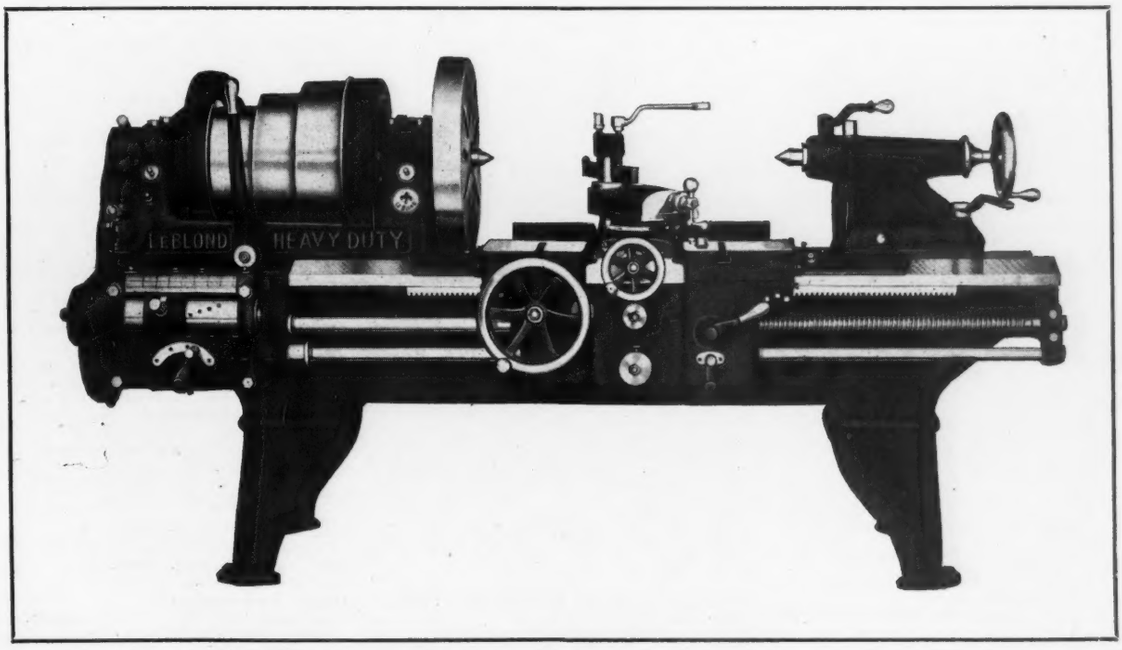
# LONGEVITY AND
# The LeBlond Heavy Duty Lathe

It is only logical to suppose that a machine tool built with a predetermined idea of production and a careful engineering analysis of this service will be best suited to resist wear, abuse, and natural depreciation. The proper proportioning of bearings, the distribution of stress and strain, the selection of material with relation to the duty it must perform—these factors have been given their true relative values in the design of the LeBlond Heavy Duty Lathe.

## *As Evidence:—*

The Hardened Steel Spindle Bearings running in boxes of chilled cast iron. The patent Double Friction Back Gear permitting of instantaneous changes in speed; with a driving capacity greater than the horse power transmitted by the driving belt. The Single Piece Box Section Apron with all drop forged heat treated gears and hardened shafts.

ASSURE A LONG PRODUCTIVE LIFE




## The R. K. LeBlond Machine Tool Co.
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Rockford Tool Co., Rockford, Ill. 15" and 16".
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Shepard Lathe Co., Cincinnati, O. 10" and 12".
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Sidney Machine Tool Co., Sidney, O. 15" to 36".
Springfield Mch. Tool Co., Springfield, O. 14" to 36", inclusive.
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Taylor Machine Co., Cleveland, O. 20".
Victor Lathe Co., 151 Lafayette St., New York 9".
Walcott Lathe Co., 115 Calhoun St., Jackson, Mich. 14" to 20", inclusive.
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Worcester Lathe Co., Worcester, Mass. 11", 13" and 16".
Wright, David A., Chicago, Ill. 34", 40", 50", 60", 72", 84".

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Harrington, Son & Co., Inc., Edwin, Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., 119 West 40th St., New York.
Sebastian Lathe Co., Cincinnati, O.

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Reed-Prentice Co., F. E. Reed Dept. and Prentice Bros. Dept., Worcester, Mass.
Seneca Falls Mfg. Co., Inc., 381 Fall St., Seneca Falls, N. Y.
Shepard Lathe Co., Cincinnati, O.

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Niles-Bement-Pond Co., 111 Broadway, New York.

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Summitt Mch. Wks., Worcester, Mass.

### Lathes, Pulley

Cincinnati Pulley Mchy. Co., Cincinnati, O.

### Lathes, Shaft

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Fitchburg Machine Works, Fitchburg, Mass.
Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York.
Niles-Bement-Pond Co., 111 Broadway, New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Oliver Machinery Co., Worcester, Mass.
Potter Tool & Machine Works, S. A., 77 E. 130th St., New York.
Summitt Mch. Wks., Worcester, Mass.

### Lathes, Turret

See also Chucking Machines.
Acme Mch. Tool Co., Cincinnati, O.
Bardons & Oliver, Cleveland, O.
Bridgeford Mch. Tool Works, 151 Winton Road, Rochester, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mch. Tool Co., Bridgeport, Conn.
Davis Mch. Tool Co., Inc., Rochester, N. Y.
Dreses Mch. Tool Co., Cincinnati, O.
Foster Machine Co., Elkhart, Ind.
Garvin Mch. Co., Spring and Varick Sts., New York.
Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis.
Greaves-Klusman Tool Co., Cincinnati, O.
International Mch. Tool Co., Indianapolis, Ind.
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LeBlond Mch. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
Morris Mch. Tool Co., Cincinnati, O.
New Britain Mch. Tool Co., New Britain, Conn.
Oliver Machinery Co., Grand Rapids, Mich.
Pratt & Whitney Co., Hartford, Conn.
Reed-Prentice Co., F. E. Reed Dept. and Prentice Bros. Dept., Worcester, Mass.
Rivett Lathe & Grinder Co., Brighton, Boston, Mass.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
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Warner & Swasey Co., Cleveland, O.
Wood Turret Mch. Co., Brazil, Ind.

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Royersford Foundry & Mch. Co., 64 N. 5th St., Philadelphia, Pa.
Texas Company, 17 Battery Place, New York.

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Michigan Lubricator Co., Detroit, Mich.

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Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.

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See Arbors and Mandrels, Expanding and Solid.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Martin Machine Co., Greenfield, Mass.
Noble & Westbrook Mfg. Co., Hartford, Conn.
V & O Press Co., Glendale, Long Island, N. Y.

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Johansson, Inc., C. E., 245 W. 55th St., New York.
Pratt & Whitney Co., Hartford, Conn.
Roger Works, Inc., J. M., Gloucester City, N. J.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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See Drilling and Milling Machines, Vertical.

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### Milling Attachments

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Cleveland Milling Mch. Co., Cleveland, O.
Garvin Mch. Co., Spring and Varick Sts., New York.
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Ingersoll Milling Machine Co., Rockford, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
LeBlond Mch. Tool Co., R. K., Cincinnati, O.
Oesterlein Mch. Co., Cincinnati, O.
Porter-Cable Mch. Co., Syracuse, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder Co., Brighton, Boston, Mass.
Rockford Milling Machine Co., Rockford, Ill.
Standard Engineering Works, Pawtucket, R. I.
Whitney Mfg. Co., Hartford, Conn.

### Milling Machines, Automatic

Pratt & Whitney Co., Hartford, Conn.

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Ames Co., B. C., Waltham, Mass.
Burke Machine Tool Co., Conneaut, O.
Carter & Hakes Co., Sterling Place, Winsted, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Bros., Inc., Berteau and Ravenswood Aves., Chicago, Ill.
Rockford Milling Machine Co., Rockford, Ill.
Sloan & Chace Mfg. Co., Ltd., Newark, N. J.
Van Norman Mch. Tool Co., Waltham Ave., Springfield, Mass.

### Milling Machines, Circular Continuous

Becker Milling Machine Co., Hyde Park, Mass.
Gould & Eberhardt, Newark, N. J.
Kearney & Trecker Co., Milwaukee, Wis.

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Adams Co., Dubuque, Iowa.
Becker Milling Machine Co., Hyde Park, Mass.
Biggs-Watterson Co., Cleveland, O.
Bristol Machine Tool Co., Bristol, Conn.
Burke Machine Tool Co., Conneaut, O.
Carter & Hakes Co., Sterling Place, Winsted, Conn.
Cleveland Milling Mch. Co., Cleveland, O.
Davenport Mfg. Co., Meadville, Pa.
Defiance Mch. Wks., Defiance, O.
Garvin Mch. Co., Spring and Varick Sts., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rockford Milling Mch. Co., Rockford, Ill.
Standard Engineering Works, Pawtucket, R. I.
Steptoe Co., John, Brighton, Cincinnati, O.
Superior Machine & Engineering Co., Detroit, Mich.
Van Norman Mch. Tool Co., Waltham Ave., Springfield, Mass.
Whitney Mfg. Co., Hartford, Conn.

### Milling Machines, Horizontal, Plain

Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Providence, R. I.
Becker Milling Machine Co., Hyde Park, Mass.
Bilton Mch. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati, O.
Cleveland Milling Mch. Co., Cleveland, O.
Davenport Mfg. Co., Meadville, Pa.
Defiance Mch. Wks., Defiance, O.
Garvin Mch. Co., Spring and Varick Sts., New York.
Gooley & Edlund, Inc., Cortland, New York.
Hendey Machine Co., Torrington, Conn.
Ingersoll Milling Machine Co., Rockford, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Co., Milwaukee, Wis.
LeBlond Mch. Tool Co., R. K., Cincinnati, O.
Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., 111 Broadway, New York.
Oesterlein Mch. Co., Cincinnati, O.
Pratt & Whitney Co., Hartford, Conn.
Rockford Milling Mch. Co., Rockford, Ill.
Standard Engineering Works, Pawtucket, R. I.
Steptoe Co., John, Brighton, Cincinnati, O.

### Milling Machines, Horizontal, Universal

Becker Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati, O.
Cleveland Milling Mch. Co., Cleveland, O.
Defiance Mch. Wks., Defiance, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
LeBlond Mch. Tool Co., R. K., Cincinnati, O.
Niles-Bement-Pond Co., 111 Broadway, New York.
Oesterlein Mch. Co., Cincinnati, O.
Rockford Milling Mch. Co., Rockford, Ill.
Rowbottom Mch. Co., Waterbury, Conn.
Van Norman Mch. Tool Co., Waltham Ave., Springfield, Mass.

### Milling Machines, Lincoln Type

Beaman & Smith Co., Providence, R. I.
Becker Milling Machine Co., Hyde Park, Mass.
Garvin Mch. Co., Spring and Varick Sts., New York.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., Hartford, Conn.
Van Norman Mch. Tool Co., Waltham Ave., Springfield, Mass.

### Milling Machines, Multiple Spindle

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Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., 111 Broadway, New York.

### Milling Machines, Oscillating Head

Superior Machine & Engineering Co., Detroit, Mich.

### Milling Machines, Portable

Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Pedrick Tool & Mch. Co., 3639 N. Lawrence St., Philadelphia, Pa.
Underwood Corp., H. B., Philadelphia, Pa.

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Pratt & Whitney Co., Hartford, Conn.
Standard Engineering Works, Pawtucket, R. I.

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Becker Milling Machine Co., Hyde Park, Mass.
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati, O.
Cochrane-Bly Co., Rochester, N. Y.
Garvin Mch. Co., Spring and Varick Sts., New York.
Ingersoll Milling Machine Co., Rockford, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
LeBlond Mch. Tool Co., R. K., Cincinnati, O.
Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., 111 Broadway, New York.
Van Norman Mch. Tool Co., Waltham Ave., Springfield, Mass.

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### Model and Experimental Work

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Pannier Bros. Stamp Co., Pittsburgh, Pa.
Schwerdtle Stamp Co., Bridgeport, Conn.

### Name Plates, Etched

Matthews & Co., Jas. H., 3946 Forbes Field, Pittsburgh, Pa.
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Schwerdtle Stamp Co., Bridgeport, Conn.

### Name Plates, Stamped

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Driver-Harris Co., Harrison, N. J.

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Bignall & Keeler Mch. Wks., Edwardsville, Ill.
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Murchey Mch. & Tool Co., 34 Porter St., Detroit, Mich.
Saunders Sons, D., Yonkers, N. Y.
Standard Engineering Co., Ellwood City, Pa.

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Craftsman Tool Co., Conneaut, O.

### Nuts, Castellated

Lippincott, A. H. & F. H., Philadelphia, Pa.
National Acme Co., Cleveland, O.

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See Bolt and Nut Machinery.

### Odometers

Veeder Mfg. Co., 39 Sergeant St., Hartford, Conn.

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Besly & Co., Chas. H., 120-B N. Clinton St., Chicago, Ill.
Bowen Products Corp., Detroit, Mich.
Gits Bros. Mfg. Co., 1940 So. Kilbourne Ave., Chicago, Ill.
Michigan Lubricator Co., Detroit, Mich.
Tucker, W. M. & C. F., Hartford, Conn.

### Oilers, Loose Pulley

Brown Engineering Co., 133 N. 3rd St., Reading, Pa.
Michigan Lubricator Co., Detroit, Mich.

### Oil Gages

Michigan Lubricator Co., Detroit, Mich.

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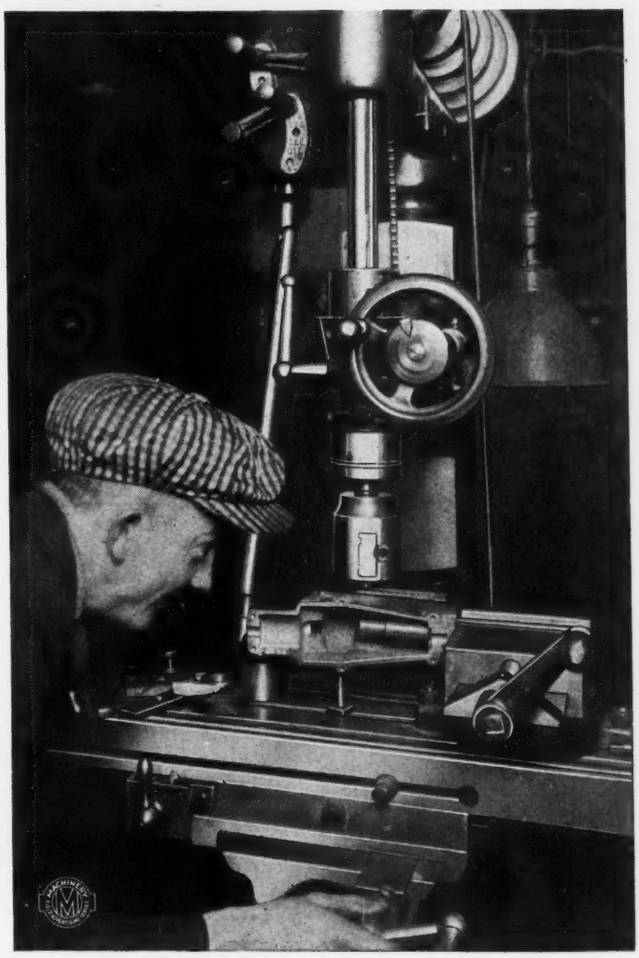
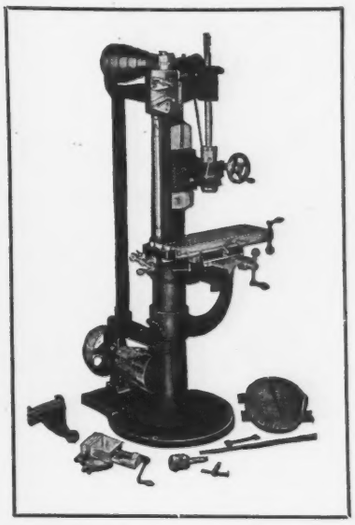
# KNIGHT
## Milling and Drilling Machines





**Their Range and Convenience are Particularly Appreciated in This Plant**

THIS Knight—a No. 1½—is finishing slots in a cast-iron gear guard. Slots are 3/16" wide and are made by sinking a milling cutter vertically into the piece. The Knight is then used for finishing the ends of the slots. The micrometer index on the slide is most convenient in locating the cutter. The micrometer index on the table comes into play in determinining the length of the slot.

There are four "Knights" in the Jersey City plant of the Davis-Bournonville Company, and they are found extremely useful on the large amount of experimental work done in this plant.

***Send for complete details, four sizes, all with the tilting table***

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Tucker, W. M. & C. F., Hartford, Conn.

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Oil City Oil & Grease Co., Oil City, Pa.
Texas Company, 17 Battery Place, New York.

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Oil City Oil & Grease Co., Oil City, Pa.
Texas Company, 17 Battery Place, New York.

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**Oxy-Hydrogen Apparatus**
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Littleford Bros., Cincinnati, O.
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Walker Co., O. S., Worcester, Mass.

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Defiance Mch. Wks., Defiance, O.
Oliver Machinery Co., Grand Rapids, Mich.

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Oliver Machinery Co., Grand Rapids, Mich.

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S-P Manufacturing Co., Cleveland, O.
Sweet & Doyle Foundry & Mch. Co., Green Island, Albany Co., N. Y.

**Patterns, Wood**
S-P Manufacturing Co., Cleveland, O.
Sweet & Doyle Foundry & Mch. Co., Green Island, Albany Co., N. Y.
V & O Press Co., Glendale, Long Island, N. Y.

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American Lead Pencil Co., 230 Fifth Ave., New York.
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Curtis & Curtis Co., 8 Garden St., Bridgeport, Conn.
Foote-Burt Co., Cleveland, O.
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Harrington Son & Co., Inc., Edwin, Philadelphia, Pa.
Hart Mfg. Co., 7. 20th St. and Marion Ave., Cleveland, O.
Landis Mch. Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., 15 Curtis St., Toledo, O.
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Saunders' Sons, Inc., D., Yonkers, N. Y.
Standard Engineering Co., Ellwood City, Pa.
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American Tool Works Co., Cincinnati, O.
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Cincinnati Planer Co., Cincinnati, O.
Cincinnati Shaper Co., Cincinnati, O.
Cleveland Planer Co., 3152 Superior Ave., Cleveland, O.
Gray Co., G. A., Cincinnati, O.
Hamilton Mch. Tool Co., Hamilton, O.
Lee Co., Frank H., Danbury, Conn.
Liberty Mch. Tool Co., Hamilton, O.
Morton Mfg. Co., Muskegon Heights, Mich.
Niles-Bement-Pond Co., 111 Broadway, New York.
Ohio Machine Tool Co., Kenton, O.
Rockford Mch. Tool Co., Rockford, Ill.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Whitcomb-Blaisdell Mch. Tool Co., Worcester, Mass.
Wilson Mch. Co., W. A., Rochester, N. Y.
Woodward & Powell Planer Co., Worcester, Mass.
Wright, David A., Chicago, Ill.

**Planers, Open Side**
Automatic Mch. Co., Bridgeport, Conn.
Cleveland Planer Co., Cleveland, O.
Simmons Mch. Co., Inc., Albany, N. Y.

**Planers, Portable**
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**Planers, Rotary**
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Niles-Bement-Pond Co., 111 Broadway, New York.
Pedrick Tool & Machine Co., 3639 N. Lawrence St., Philadelphia, Pa.
Underwood Corp., H. B., Philadelphia, Pa.

**Plate Rolls**
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Moltrup Steel Products Co., Beaver Falls, Pa.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Keller Pneumatic Tool Co., Grand Haven, Mich.
Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York.
Pressed Metal Machinery Co., 15 S. Clinton St., Chicago, Ill.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Builders Iron Foundry, Providence, R. I.
Defiance Mch. Works, Defiance, O.
Diamond Mch. Co., Providence, R. I.
Forbes & Myers, 178 Union St., Worcester, Mass.
Gardner Mch. Co., Beloit, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
New Britain Mch. Co., New Britain, Conn.
Potter Tool & Machine Works, S. A., 77 E. 130th St., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Royersford Fdry. & Mch. Co., 54 N. 5th St., Philadelphia, Pa.
Sterling Grinding Wheel Co., Tiffin, O.
Stow Mfg. Co., Binghamton, N. Y.
United States Electrical Tool Co., 6th Ave. and Mt. Hope St., Cincinnati, O.
Webster & Perks Tool Co., Springfield, O.

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Bleyney Mch. Co., Greenfield, Mass.
Hawes, C. L., Ashtabula, O.

**Presses, Arbor**
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Bucher-Smith Co., East Liverpool, O.
Luchas Mch. Tool Co., Cleveland, O.
Nicholson & Co., W. H., 112 Oregon St., Wilkes-Barre, Pa.

**Presses, Broaching**
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Hydraulic Press Mfg. Co., 84 Lincoln Ave., Mt. Gilead, O.
Metalwood Mfg. Co., Detroit, Mich.
Swaine Mfg. Co., F. J., St. Louis, Mo.
Toledo Mch. & Tool Co., Toledo, O.
V & O Press Co., Glendale, Long Island, N. Y.
Watson-Stillman Co., 192 Fulton St., New York.

**Presses, Drop**
See Hammers, Drop.

**Presses, Foot**
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Etna Machine Co., Toledo, O.
Ferracute Mch. Co., Bridgeton, N. J.
Niagara Mch. & Tool Works, Buffalo, N. Y.
Shuster Co., F. B., New Haven, Conn.
Swaine Mfg. Co., F. J., St. Louis, Mo.
Taylor & Fenn Co., Hartford, Conn.
Toledo Mch. & Tool Co., Toledo, O.
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Ferracute Mch. Co., Bridgeton, N. J.
Niagara Mch. & Tool Works, Buffalo, N. Y.
Swaine Mfg. Co., F. J., St. Louis, Mo.
Toledo Mch. & Tool Co., Toledo, O.
Treadwell Engineering Co., Easton, Pa.
V & O Press Co., Glendale, Long Island, N. Y.

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Eastern Production Co., Detroit, Mich.
Elmes Engineering Works, Chas. F., 222 N. Morgan St., Chicago, Ill.
Hydraulic Press Mfg. Co., 84 Lincon Ave., Mt. Gilead, O.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., 111 Broadway, New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Treadwell Engineering Co., Easton, Pa.
Watson-Stillman Co., 192 Fulton St., New York.

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Atlas Press Co., 323 N. Park St., Kalamazoo, Mich.
Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.
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Enterprise Mchy. Co., 26 S. Clinton St., Chicago, Ill.
Lucas Mch. Tool Co., Cleveland, O.
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**Presses, Roll and Dial Feed for**
Acme Machine Works, 4125 Ravenswood Ave., Chicago, Ill.

**Presses, Screw**
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Ferracute Mch. Co., Bridgeton, N. J.
Globe Mch. & Stamping Co., Cleveland, O.
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Swaine Mfg. Co., F. J., St. Louis, Mo.
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Biggs-Watterson Co., Cleveland, O.
Bliss Co., E. W., Brooklyn, N. Y.
Buckeye Engine Co., Salem, O.
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Niagara Mch. & Tool Works, Buffalo, N. Y.
Pressed Metal Mchy. Co., 15 So. Clinton St., Chicago, Ill.
Stoll Co., Inc., D. H., Buffalo, N. Y.
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Taylor-Shantz Co., Rochester, N. Y.
Toledo Mch. & Tool Co., Toledo, O.
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Elmes Engineering Works, Chas. F., 222 N. Morgan St., Chicago, Ill.
Hydraulic Press Mfg. Co., 84 Lincon Ave., Mt. Gilead, O.
Metalwood Mfg. Co., Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Foundry & Mch. Co., Inc., Ypsilanti, Mich.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
Watson-Stillman Co., 192 Fulton St., New York.

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National Foundry & Mch. Co., Inc., Ypsilanti, Mich.
Toledo Mch. & Tool Co., Toledo, O.
V & O Press Co., Glendale, Long Island, N. Y.

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Newton Mch. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.

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Creason-Morris Co., Philadelphia, Pa.
Johnson Mch. Co., Carlyle, Manchester, Conn. (Friction).
Jones Foundry & Mch. Co., W. A., 4409 W. 12th St., Chicago, Ill.
Moore & White Co., 2707-2737 N. 15th St., Philadelphia, Pa.
Saginaw Mfg. Co., Saginaw, Mich.
Wood Sons Co., T. B., Chambersburg, Pa.

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Brown Co., A. & F., 79 Barclay St., New York.
Caldwell & Son Co., H. W., 17th St. and Western Ave., Chicago, Ill.
Conway & Co., Cincinnati, O.
Creason-Morris Co., Philadelphia, Pa.
Hanson Clutch & Mchy. Co., Tiffin, O.
Johnson Mch. Co., Carlyle, Manchester, Conn.
Jones Foundry & Mch. Co., W. A., 4409 W. 12th St., Chicago, Ill.
Link-Belt Company, Chicago, Ill.
Moore & White Co., 2707-2737 N. 15th St., Philadelphia, Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
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Elmes Engineering Works, Chas. F., 222 N. Morgan St., St. Louis, Mo.
Hydraulic Press Mfg. Co., 84 Lincoln Ave., Mount Gilead, O.
Metalwood Mfg. Co., Detroit, Mich.
Watson-Stillman Co., 192 Fulton St., New York.

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Michigan Lubricator Co., Detroit, Mich.
Trahern Pump Co., Rockford, Ill.

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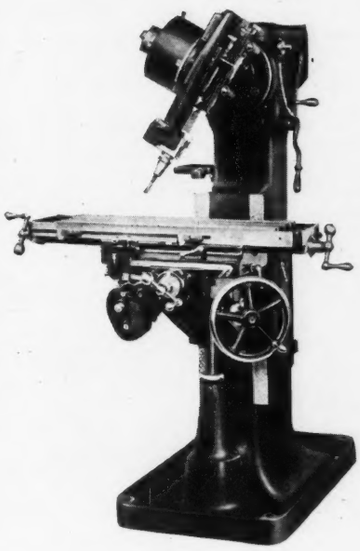

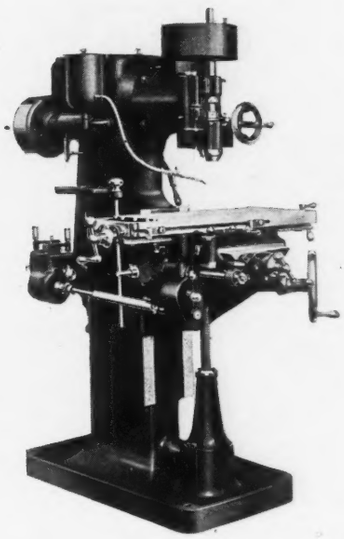

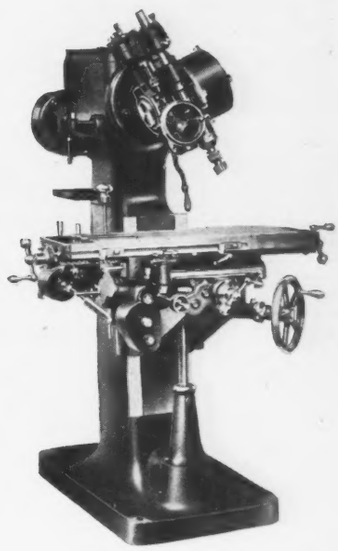

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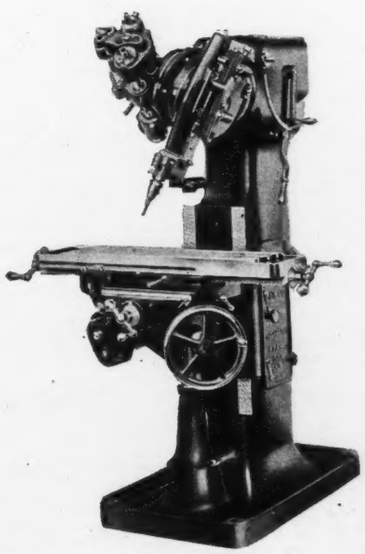

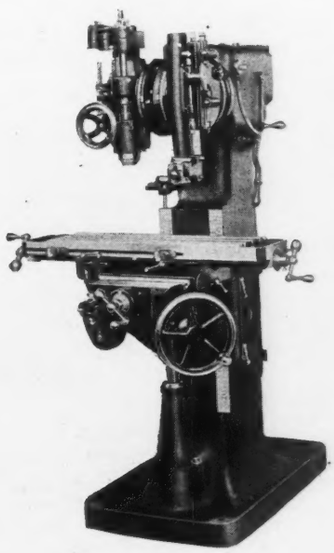

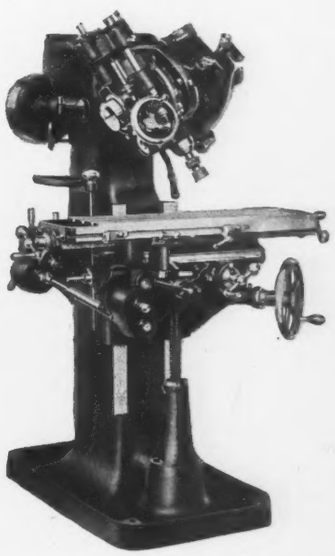

**Pumps, Pneumatic**
Ingersoll-Rand Co., 11 Broadway, New York.

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Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York.
Pressed Metal Machinery Co., 15 S. Clinton St., Chicago, Ill.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

**Riveters, Steam**
Hanna Eng. Works, 1763 Elston Ave., Chicago, Ill.

**Riveting Machines**
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Blomquist-Eck Mch. Co., Cleveland, O.
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Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.
Hanna Eng. Works, 1763 Elston Ave., Chicago, Ill.
High Speed Hammer Co., Inc., Rochester, N. Y.
Niles-Bement-Pond Co., 111 Broadway, New York.
Pressed Metal Machinery Co., 15 S. Clinton St., Chicago, Ill.
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Rich Tool Co., Railway Exchange, Chicago, Ill.

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Tucker, W. M. & C. F., Hartford, Conn.

**Rod Cutting Machines**
Union Mfg. Co., New Britain, Conn.

**Rolling Machines, Tapered Forging**
Ajax Mfg. Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

**Rolling Mill Machinery**
Ajax Mfg. Co., Cleveland, O.
Blake & Johnston Co., Waterbury, Conn.
Fawcus Machine Co., Pittsburgh, Pa.

**Rope Dressing and Preservative**
Link-Belt Company, Chicago, Ill.

**Rope Drives**
Link-Belt Company, Chicago, Ill.

**Rules, Steel**
Almond Mfg. Co., T. R., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hammacher, Schlemmer & Co., 4th Ave. and 13th St., New York.
Keuffel & Esser Co., Hoboken, N. J.
Starrett Co., L. S., Athol, Mass.

**Rust Preventive**
American Chemical Paint Co., Philadelphia, Pa.
Oakley Chemical Co., 26 Thames St., New York.
Oil City Oil & Grease Co., Oil City, Pa.

**Rust Proofing Process**
American Chemical Paint Co., Philadelphia, Pa.

**Sand Blast Equipment**
American Chemical Paint Co., Philadelphia, Pa.
Curtis Pneumatic Machinery Co., 1568 Kienlen Ave., St. Louis, Mo.
Leiman Bros., 62 E-2 John St., New York.
Link-Belt Company, Chicago, Ill.

**Saw Blades, Hack**
Atkins & Co., E. C., Indianapolis, Ind.
Blum & Co., Julius, 510 W. 24th St., New York.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Hammacher, Schlemmer & Co., 4th Ave. and 13th St., New York.
Montgomery & Co., Inc., 105 Fulton St., New York.
Napier Saw Works, Inc., 5 Napier St., Springfield, Mass.
Simonds Mfg. Co., Fitchburg, Mass.
Starrett Co., L. S., Athol, Mass.
Sterling Products Co., 547 W. Washington Blvd., Chicago, Ill.
Thompson & Son, Co., Henry G., New Haven, Conn.
Victor Saw Works, Springfield, Mass.
West Haven Mfg. Co., New Haven, Conn.

**Saw Frames, Hack**
Atkins & Co., E. C., Indianapolis, Ind.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Hammacher, Schlemmer & Co., 4th Ave. and 13th St., New York.
Montgomery & Co., Inc., 105 Fulton St., New York.
Napier Saw Works, Inc., 5 Napier St., Springfield, Mass.
Simonds Mfg. Co., Fitchburg, Mass.
Starrett Co., L. S., Athol, Mass.
Thompson & Son, Co., Henry G., New Haven, Conn.
Victor Saw Works, Springfield, Mass.
West Haven Mfg. Co., New Haven, Conn.

**Saw Guards, Circular**
Atkins & Co., E. C., Indianapolis, Ind.
Machinery Co. of America, Big Rapids, Mich.

**Sawing Machines, Circular**
Billings & Spencer Co., Hartford, Conn.
Burr & Son, John T., 429 Kent Ave., Brooklyn, N. Y.
Cochrane-Bly Co., Rochester, N. Y.
Earle Gear & Mch. Co., 4705 Stenton Ave., Philadelphia, Pa.
Espen-Lucas Machine Works, Philadelphia, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Harrington, Son & Co., Inc., Edwin, Philadelphia, Pa.
Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Q M S Co., 1763 Elston Ave., Chicago, Ill.
V & O Press Co., Glendale, Long Island, N. Y.
Vandyck Churchill Co., 149 Broadway, New York.

**Sawing Machines, Metal Band**
Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago, Ill.
Machinery Co. of America, Big Rapids, Mich.
Racine Tool & Machine Co., Racine, Wis.
Thompson & Son, Co., Henry G., New Haven, Conn.
V & O Press Co., Glendale, Long Island, N. Y.

**Sawing Machines, Power Hack**
Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago, Ill.
Atkins & Co., Inc., E. C., Indianapolis, Ind.
Bucher-Smith Co., East Liverpool, O.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Napier Saw Works, Inc., 5 Napier St., Springfield, Mass.
Peerless Machine Co., Racine, Wis.
Q M S Co., 1763 Elston Ave., Chicago, Ill.
Racine Tool & Machine Co., Racine, Wis.
Thompson & Son, Co., Henry G., New Haven, Conn.
Victor Saw Works, Springfield, Mass.
Western Tool & Mfg. Co., Springfield, O.
West Haven Mfg. Co., New Haven, Conn.

**Sawing Machines, Wood**
Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.
Crescent Mch. Co., 56 Main St., Leetonia, O.
Oliver Machinery Co., Grand Rapids, Mich.
Woods Engineering Co., Alliance, O.

**Saws, Circular**
Atkins & Co., Inc., Indianapolis, Ind.
Crescent Mch. Co., 56 Main St., Leetonia, O.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Hunter Saw & Mch. Co., Pittsburgh, Pa.
Huther Bros. Saw Mfg. Co., 1108 University Ave., Rochester, N. Y.
Napier Saw Works, Inc., 5 Napier St., Springfield, Mass.
Pittsburgh Saw & Mfg. Co., Pittsburgh, Pa.
Simonds Mfg. Co., Fitchburg, Mass.

**Saws, Friction**
Hunter Saw & Mch. Co., Pittsburgh, Pa.

**Saws, Metal Band**
Atkins & Co., Inc., Indianapolis, Ind.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Huther Bros. Saw Mfg. Co., 1108 University Ave., Rochester, N. Y.
Napier Saw Works, Inc., 5 Napier St., Springfield, Mass.
Thompson & Son Co., Henry G., New Haven, Conn.
West Haven Mfg. Co., New Haven, Conn.

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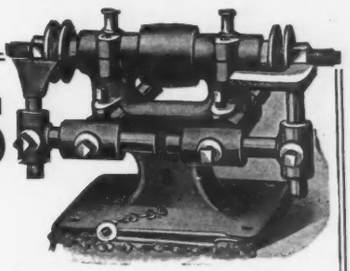
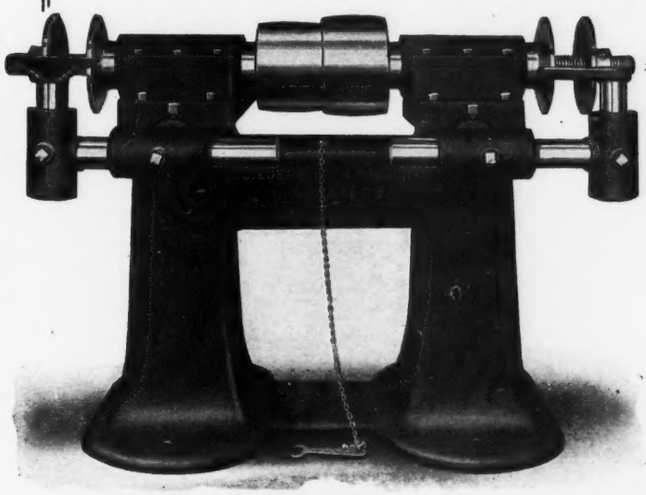
# BUILDERS Safety Pull Counter-Shaft GRINDERS



Builders Grinders are old-timers that have kept pace with modern developments. Designs incorporate all worthwhile features of modern developments, but disregard fads and "improvements" which serve only to complicate.

Rigid, well balanced and with distinctive advantages in lubrication and control, they cover the field—from foundry to toolroom. 99 years on the market and with a reputation second to none.

Some manufacturers have several of our 8" Tool Grinders distributed in different parts of the shop. They find it pays, both in time saved and improved workmanship.



This Heavy Duty Floor Machine takes wheels up to 24" x 4" x 2½" and is suitable for the heaviest foundry and machine shop grinding. It has long, self-oiling, babbitted boxes and a special countershaft equipped with our Patented "Pull" Belt Shifter. Catalog describes the whole line.

**BUILDERS IRON FOUNDRY**
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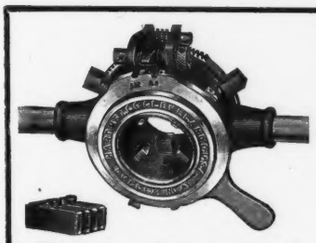

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### With Positive Control

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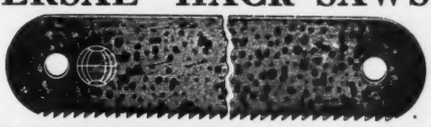

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**73 Pearl St. BOSTON, MASS.**

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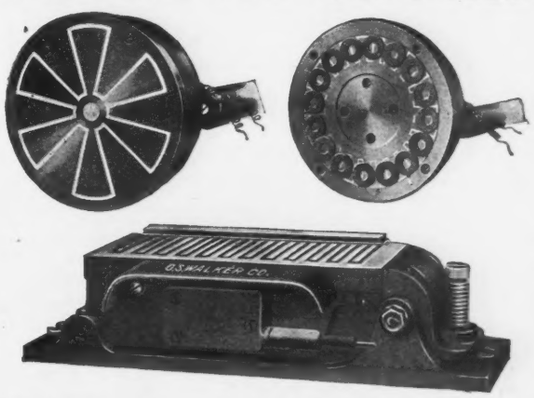


"The best way to hold most work, the only way to hold some of it". The uses for Walker Magnetic Chucks, supplemented by Walker Demagnetizers, are fully described in the catalogue. Send for it.

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MAGNETIC CHUCKS GRINDING MACHINES
Successors to O. S. Walker & Co. and Walker Grinder Co.
WORCESTER, MASSACHUSETTS, U.S.A.

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Crescent Mch. Co., 56 Main St., Leetonia, O.
Oliver Machinery Co., Grand Rapids, Mich.

### Scraping Tool, Metal, Power Driven
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### Scraping Tables
New Britain Mch. Co., New Britain, Conn.

### Screw Cutting Tools
See Taps and Dies.

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Cincinnati Automatic Mch. Co., Oakley, Cincinnati, O.
Cleveland Automatic Mch. Co., Cleveland, O.
Cone Automatic Mch. Co., Windsor, Vt.
National Acme Co., Cleveland, O.
New Britain Mch. Co., New Britain, Conn.
Pratt & Whitney Co., Hartford, Conn.
P. W. V. Automatic Mch. Corp., Fitchburg, Mass.

### Screw Machines, Hand
See Lathes, Turret.
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Bardons & Oliver, Cleveland, O.
Biggs-Watterson Co., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Defiance Machine Works, Defiance, O.
Dreses Machine Tool Co., Cincinnati, O.
Foster Mch. Co., Elkhart, Ind.
Garvin Mch. Co., Spring and Varick Sts., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Oliver Machinery Co., Grand Rapids, Mich.
Pratt & Whitney Co., Hartford, Conn.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Rivett Lathe & Grinder Co., Brighton, Boston, Mass.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mch. Co., Brazil, Ind.
Wright, David A. Chicago, Ill.

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Cleveland Automatic Mch. Co., Cleveland, O.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
National Acme Co., Cleveland, O.
New Britain Mch. Co., New Britain, Conn.
P. W. V. Automatic Mch. Corp., Fitchburg, Mass.

### Screw Machine Tools and Equipment
Bardons & Oliver, Cleveland, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Automatic Mch. Co., Oakley, Cincinnati, O.
Cleveland Automatic Mch. Co., Cleveland, O.
Davis Mch. Tool Co., Inc., Wm. F., 549 W. Washington Blvd., Chicago, Ill.
Foster Mch. Co., Elkhart, Ind.
Garvin Mch. Co., Spring and Varick Sts., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Harris Engineering Co., H. E., Bridgeport, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., Cleveland, O.
New Britain Mch. Co., New Britain, Conn.
Oliver Machinery Co., Grand Rapids, Mich.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Steinle Turret Mch. Co., Madison, Wis.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mch. Co., Brazil, Ind.

### Screw Machine Work
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Barnes Co., Wallace, South and Parallel Sts., Bristol, Conn.
Blum & Co., Julius, 510 W. 24th St., New York.
Breeze Mfg. Co., Newark, N. J.
Brown Engineering Co., 133 N. 3rd St., Reading, Pa.
Eastern Mch. Screw Corp., New Haven, Conn.
Hanes Mch. Co., Inc., Harvey, Buffalo, N. Y.
K & Z Automatic Screw Co., Defiance, O.
Legler-Eilerman Co., Dayton, O.
Lippincott, A. H., & H. F., Philadelphia, Pa.
Meisel Press Mfg. Co., 945 Dorchester Ave., Boston, Mass.
National Acme Co., Cleveland, O.
New Britain Mch. Co., New Britain, Conn.
Potter Tool & Mch. Works, S. A., 77 E. 130th St., New York.
Reliance Die & Stamping Co., 515 N. La Salle St., Chicago, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wilcox Motor & Mfg. Co., Saginaw, Mich.

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Bay State Tap & Die Co., Mansfield, Mass.
Bealy & Co., Chas. H., 120-B N. Clinton St., Chicago, Ill.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hart Mfg. Co., E. 20th St. and Marion Ave., Cleveland, O.
Hjorth Lathe & Tool Co., Boston, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

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Hammacher, Schlemmer & Co., 4th Ave. and 13th St., New York.
Hindley Gear Co., Philadelphia, Pa.
National Acme Co., Cleveland, O.
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### Screws, Machine
Allen Mfg. Co., Hartford, Conn.
Eastern Mch. Screw Corp., New Haven, Conn.
Hammacher, Schlemmer & Co., 4th Ave. and 13th St., New York.
Hindley Gear Co., Philadelphia, Pa.
Lippincott, A. H. & F. H., Philadelphia, Pa.
National Acme Co., Cleveland, O.

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Automatic Mch. Co., Bridgeport, Conn.

### Seamless Steel Tubing
See Tubing, Seamless Steel.

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Baird Mchy. Co., W. J., Detroit, Mich.
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Cleveland Belting & Mchy. Co., Cleveland, O.
Conn, Ltd., C. G., Elkhart, Ind.
Craven Research Laboratories, Pittsburgh, Pa.
Davis Mch. Tool Co., Inc., Rochester, N. Y.
Enterprise Machinery Co., 26 S. Clinton St., Chicago, Ill.
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Hill, Clarke & Co. of Chicago, 649 Washington Blvd., Chicago, Ill.
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Lucas & Son, J. L., Bridgeport, Conn.
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Marshall & Huschart Mchy. Co., 17 S. Jefferson St., Chicago, Ill.
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### Shafting, Steel
Aborn Steel Co., Inc., 26 Clarke St., New York.
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Brown Co., A. & F., 79 Barclay St., New York.
Cresson-Morris Co., Philadelphia, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Royersford Foundry & Mch. Co., 54 N. 5th St., Philadelphia, Pa.
Standard Pressed Steel Co., Philadelphia, Pa.
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Queen City Mch. Tool Co., Cincinnati, O.
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Sellew Mch. Tool Co., Pawtucket, R. I.
Simmons Mch. Co., Inc., Albany, N. Y.
Smith & Mills Co., Cincinnati, O.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
Steptoe Co., John, Cincinnati, O.
Watson-Stillman Co., 192 Fulton St., New York.

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Rhodes Mfg. Co., Hartford, Conn.

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Royersford Foundry & Mch. Co., 54 N. 5th St., Philadelphia, Pa.
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Toledo Mch. & Tool Co., Toledo, O.
Union Mfg. Co., New Britain, Conn.
Watson-Stillman Co., 192 Fulton St., New York.
Williams, White & Co., Moline, Ill.

### Shearing Machinery, Hand Power
Machinery Co. of America, Big Rapids, Mich.
Tucker, W. M. & C. F., Hartford, Conn.

### Shears, Rotary
Bliss Co., E. W., Brooklyn, N. Y.
Niagara Mch. & Tool Works, Buffalo, N. Y.
Quickwork Co., St. Marys, O.
Toledo Mch. & Tool Co., Toledo, O.

### Sheave Wheels
Jones Foundry & Mch. Co., W. A., 4409 W. 12th St., Chicago, Ill.

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New Britain Mch. Co., New Britain, Conn.
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National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes Mfg. Co., Akron, O.

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Betts Machine Co., Rochester, N. Y.
Cochrane-Bly Co., Rochester, N. Y.
Dill Machine Co., T. C., Philadelphia, Pa.
Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., 111 Broadway, New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

### Slotters, Portable
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Niles-Bement-Pond Co., 111 Broadway, New York.

### Sockets
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., 4th Ave. and 13th St., New York.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes Mfg. Co., Akron, O.

### Special Machinery and Tools
Acme Machine Works, 4125 Ravenswood Ave., Chicago, Ill.
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American Tool & Die Works, 173 Lexington Ave., Brooklyn, N. Y.
American Machine Products Co., Detroit, Mich.
Arrow Tool Co., Bridgeport, Conn.
Automatic Mch. Co., Bridgeport, Conn.
Baird Mch. Co., Bridgeport, Conn.
Beaman & Smith Co., Providence, R. I.
Betts Machine Co., Rochester, N. Y.
Bilgram Mch. Works, 1231 Spring Garden St., Philadelphia, Pa.
Blair Tool & Mch. Wks., 521 Greenwich St., New York.
Blake & Johnson Co., Waterbury, Conn.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss Co., E. W., Brooklyn, N. Y.
Brown Co., A. & F., 79 Barclay St., New York.
Carroll Engineering Co., Dayton, O.
Columbus Die, Tool & Mch. Co., Columbus, O.
Craftsman Tool Co., Conneaut, O.
Crawford Tool & Mfg. Co., 1617 So. Crawford Ave., Chicago, Ill.
Davie Tool Co., Cleveland, O.
Defiance Mch. Wks., Defiance, O.
Detroit Reamer & Tool Co., Detroit, Mich.
Earle Gear & Mch. Co., 4705 Stenton Ave., Philadelphia, Pa.
Fawcus Machine Co., Pittsburgh, Pa.
Fenn Mfg. Co., Hartford, Conn.
Garrison Machine Works, Dayton, O.
Garvin Mch. Co., Spring and Varick Sts., New York.
Gem City Mch. Co., Dayton, O.
Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis.
Glenzer Co., J. C., Detroit, Mich.
Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.
Hanes Mch. Co., Inc., Harvey, Buffalo, N. Y.
Hanna Engineering Works, 1763 Elston Ave., Chicago, Ill.
Hanson Clutch & Mch. Co., Tiffin, O.
Harris Engineering Co., H. E., Bridgeport, Conn.
Hawes, C. L., Ashtabula, O.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
Ingle Machine Co., Rochester, N. Y.
Johansson, Inc., C. E., 245 W. 55th St., New York.
Krasberg Engineering & Mfg. Corp., 536 Lake Shore Drive, Chicago, Ill.
Langelier Mfg. Co., Arlington, Cranston, R. I.
Liberty Systems Corp., St. Louis, Mo.
Lowry-Knise Tool Co., Inc., Syracuse, N. Y.
Lucas Machine Tool Co., Cleveland, O.
Mehl Mch. Tool & Die Co., Roselle, N. J.
Marvin & Casler Co., Canastota, N. Y.
Meisel Press Mfg. Co., 948 Dorchester Ave., Boston, Mass.
Meisselbach-Catucci Mfg. Co., 27 Congress St., Newark, N. J.
Meyers Gage Co., W. F., Bedford, Ind.
Miami Tool & Die Co., Dayton, O.
Modern Tool & Mch. Works, Inc., Newark, N. J.
Modern Tool Co., 2nd and State Sts., Erie, Pa.
Mueller Mch. Tool Co., Cincinnati, O.
National Acme Co., Cleveland, O.
National Automatic Tool Co., Richmond, Ind.
National Machinery Co., Tiffin, O.
National Tool Co., Cleveland, O.
National Twist Drill & Tool Co., Detroit, Mich.
Nelson Tool Co., Inc., 781-783 E. 142nd St., New York.
New Britain Mch. Co., New Britain, Conn.
Newman Mfg. Co., Cincinnati, O.
Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., 111 Broadway, New York.
Potter Tool & Mch. Works, S. A., 77 E. 130th St., New York.
Pratt & Whitney Co., Hartford, Conn.
Printing Machinery Co., Cincinnati, O.
Q M S Co., 1763 Elston Ave., Chicago, Ill.
Reed-Prentice Co., F. E. Reed Dept. and Prentice Bros. Dept., Worcester, Mass.
Reliance Die & Stamping Co., 515 N. La Salle St., Chicago, Ill.
Saphil Mfg. Corp., 141 W. Austin Ave., Chicago, Ill.

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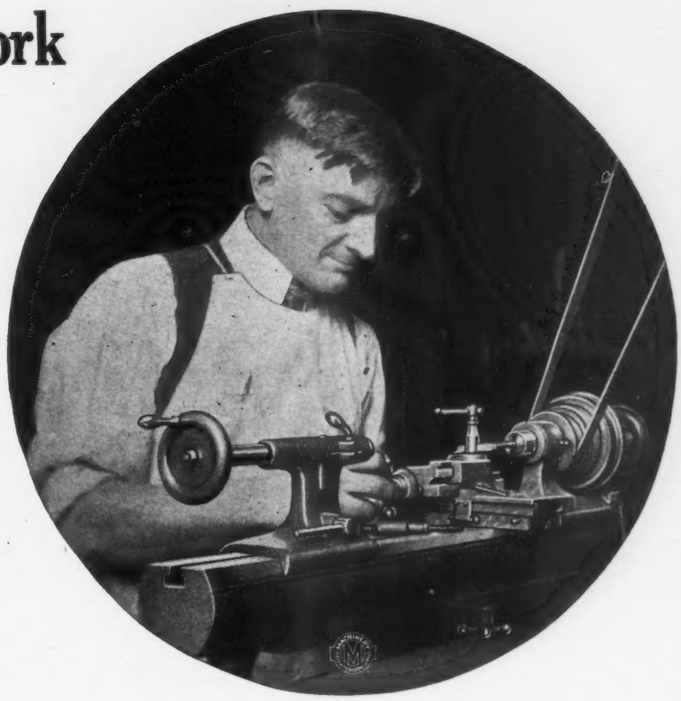
# CATARACT BENCH LATHES

## For Precision Work

*This One, for Example—*

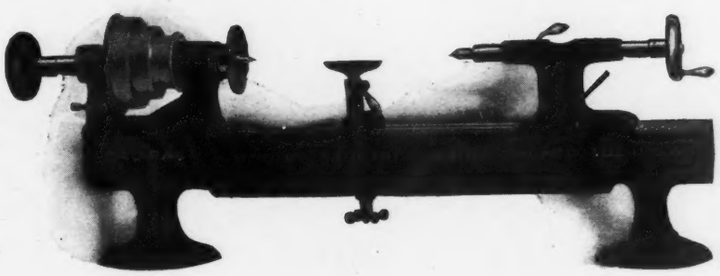
is endorsed by the superintendent of a company which has been manufacturing typewriters for over twenty years. His letter is typical and tells its own story.



"We have had a Hardinge Bros., (Cataract) Bench Lathe in our toolroom for several years and have used it on a wide variety of precise work. For turning up punches, pilots, small taper reamers, etc., we find it very convenient and accurate.

"It affords us great pleasure to unhesitatingly recommend this tool for any work within its capacity." The source of this letter is withheld from publication, but will be furnished on request.

**Cataract Bench Tools are distinguished for their accuracy and versatility, for convenient controls and fine adjustments, for their wide range and numerous attachments.**



The Cataract Quick Change Swing Precision Lathe is another development of the Hardinge Line which is notably "different" and well worth investigating.

***Catalog describes the whole line***

**HARDINGE BROS., Inc.,** **Berteau & Ravenswood Aves. CHICAGO, ILL.**

EXCLUSIVE REPRESENTATIVES: Hill, Clarke & Company, Inc., Boston, Mass., New York, N. Y., Providence, R. I., New Haven, Conn. Swind Machinery Company, Philadelphia, Pa. Mr. E. C. Chapman, Rochester, N. Y. W. M. Pattison Supply Company, Cleveland, Ohio. Cadillac Tool Company, Detroit, Mich. Vonnegut Machinery Company, Indianapolis, Ind. Colcord-Wright Machinery & Supply Co., St. Louis, Mo. Berger & Carter Company, San Francisco, and Los Angeles, Cal. EUROPEAN REPRESENTATIVES: Alfred Herbert, Ltd.

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Treadwell Engineering Co., Easton, Pa.
V & O Press Co., Glendale, Long Island, N. Y.
Waltham Machine Works, Waltham, Mass.
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Caldwell & Son Co., H. W., 17th St. and Western Ave., Chicago, Ill.
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Link-Belt Company, Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia, Pa.
Union Chain & Mfg. Co., Seville, O.
Whitney Mfg. Co., Hartford, Conn.

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Cullman Wheel Co., 1339 Altgeld St., Chicago, Ill.
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Link-Belt Company, Chicago, Ill.
Meisel Press Mfg. Co., 948 Dorchester Ave., Boston, Mass.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia, Pa.
Union Chain & Mfg. Co., Seville, O.

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Blum & Co., Julius, 510 W. 24th St., New York.
Globe Mch. & Stamping Co., Cleveland, O.
Kales Stamping Company, Detroit, Mich.
Lansing Stamping & Tool Co., Lansing, Mich.
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Youngstown Pressed Steel Co., Youngstown, O.

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Newman Mfg. Co., Cincinnati, O.
Noble & Westbrook Mfg. Co., Hartford, Conn.
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Boker & Co., Inc., H., 101 Duane St., New York.
Camden Forge Co., Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Colonial Steel Co., Pittsburgh, Pa.
Crucible Steel Forge Co., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse & Co., Inc., Peter A., 417 Canal St., New York.
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Hammond Steel Co., Inc., Syracuse, N. Y.
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Heller Bros. Co., Boston, Mass.
Johnston & Jennings Co., Addison Road and Lake Shore R. R. Tracks, Cleveland, O.
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Standard Alloys Co., Pittsburgh, Pa.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

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Steel Improvement & Forge Co., Cleveland, O.

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Allen & Co., Ltd., Edgar, 718 W. Lake St., Chicago, Ill.
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Blum & Co., Julius, 510 W. 24th St., New York.
Boker & Co., Inc., H., 101 Duane St., New York.
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Colonial Steel Co., Pittsburgh, Pa.
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Firth-Sterling Steel o., McKeesport, Pa.
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Hammond Steel Co., Inc., Syracuse, N. Y.
Hawkridge Bros. Co., Boston, Mass.
Haynes Stellite Co., Boston, Mass.
Heller Bros. Co., Boston, Mass.
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Ludlum Steel Co., Watervliet, N. Y.
Onondaga Steel Co., Inc., Syracuse, N. Y.
Syracuse Alloy Steel Co., Inc., Syracuse, N. Y.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.
Ward's Sons, Co., Edgar T., Boston, Mass.

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Apex Steel Corporation, 50 Church St., New York.
Blum & Co., Julius, 510 W. 24th St., New York.
Boker & Co., Inc., H., 101 Duane St., New York.
Camden Forge Co., Camden, N. J.
Colonial Steel Co., Pittsburgh, Pa.
Crucible Steel Forge Co., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Halcomb Steel Co., Syracuse, N. Y.
Hammond Steel Co., Inc., Syracuse, N. Y.
Hawkridge Bros. Co., Boston, Mass.
Latrobe Electric Steel Co., Latrobe, Pa.
Standard Alloys Co., Pittsburgh, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

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Pittsburgh Steel Stamp Co., Pittsburgh, Pa.

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Brubaker & Bros., W. L., 50 Church St., New York.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., . M., Pawtucket, R. I.
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
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Beaman & Smith Co., Providence, R. I.
Bicknell-Thomas Co., Greenfield, Mass.
Cincinnati Bickford Co., Oakley, Cincinnati, O.
Defiance Mch. Works, Defiance, O.
Errington Mechanical Laboratory, 39 Cortlandt St., New York.
Geometric Tool Co., New Haven, Conn.
Hammond Mfg. Co., Cleveland, O.
Leland-Gifford Co., Worcester, Mass.
Modern Tool Co., 2nd and State Sts., Erie, Pa.
Newman Mfg. Co., Cincinnati, O.
Peter Bros. Mfg. Co., 135 Railroad Ave., Algonquin, Ill.
Procunier, Wm. L., 549 W. Washington Blvd., Chicago, Ill.
Whitney Mfg. Hartford, Conn.

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Burke Mch. Tool Co., Conneaut, O.
Defiance Mch. Wks., Defiance, O.
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Langelier Mfg. Co., Arlington, Cranston, R. I.
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National Acme Co., Cleveland, O.
National Mchy. Co., Tiffin, O.
Paragon Gear Works, Taunton, Mass.
Peter Bros. Mfg. Co., 135 Railroad Ave., Algonquin, Ill.
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Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Gardner-Bryan Co., Cleveland, O.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hammacher, Schlemmer & Co., 4th Ave. and 13th St., New York.
Hardinge Bros., Inc., Berteau and Ravenswood Aves., Chicago, Ill.
Harris Engineering Co., H. E., Bridgeport, Conn.
Landis Mch. Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
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Sheffield Mch. & Tool Co., Dayton, O.
Standard Tool Co., Cleveland, O.
Sterling Products Co., 547 W. Washington Blvd., Chicago, Ill.
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National Acme Co., Cleveland, O.
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National Acme Co., Cleveland, O.
National Mchy. Co., Tiffin, O.
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Wood Turret Mch. Co., Brazil, Indiana.

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Rivett Lathe & Grinder Co., Brighton, Boston, Mass.

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See Gages, Thread.

**Thread Gage Wires**
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**Thread Lead Indicator**
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Blair Tool & Mch. Works, 521 Greenwich St., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.

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Gisholt Mch. Co., 9 S. Baldwin St., Madison, Wis.
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Lees-Bradner Co., Cleveland, O.
Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Smalley-General Co., Inc., Bay City, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Mch. Works, Waltham, Mass.
Woods Engineering Co., Alliance, O.

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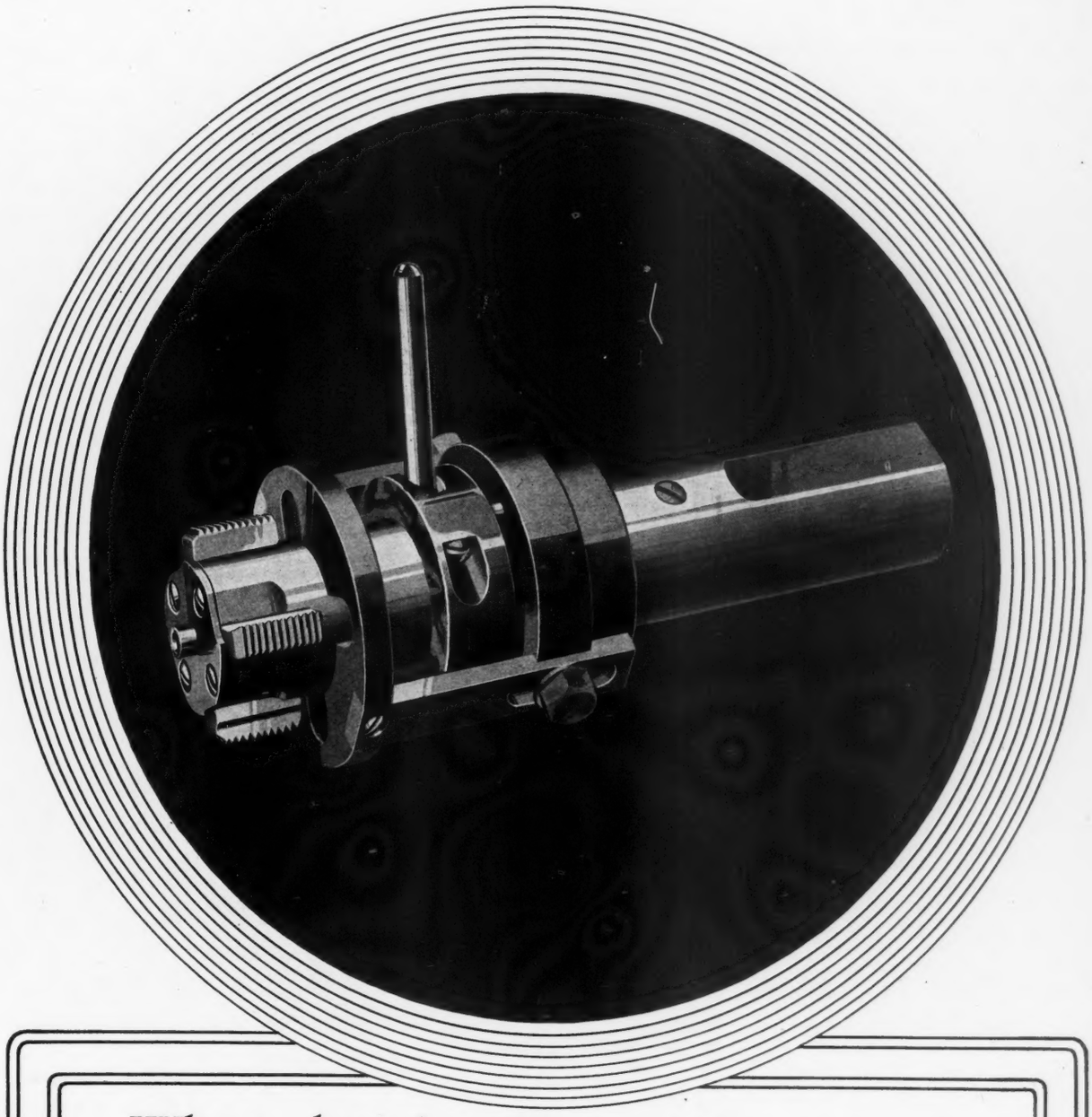

# Why it doesn't twist or strain:

When this NAMCO Collapsing Tap has cut to the required depth, the chasers disconnect themselves from the work with the same simplicity that a gear is thrown out of mesh.

Doesn't experience tell you that this new principle of construction should be the real *remedy* for failure to collapse, damaged chasers, short lived tools and inaccurate threads. We've proved it.

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Hammond Steel Co., Inc., Syracuse, N. Y.
Ludlum Steel Co., Watervliet, N. Y.
Onondaga Steel Co., Inc., Syracuse, N. Y.
Syracuse Alloy Steel Co., Inc., Syracuse, N. Y.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.

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Lovejoy Tool Co., Inc., Springfield, Vt.
O. K. Tool Holder Co., Shelton, Conn.
Osgood Tool Co., J. L., Buffalo, N. Y.
Ready Tool Co., 650 Railroad Ave., Bridgeport, Conn.
Western Tool & Mfg. Co., Springfield, O.
Williams & Co., J. H., 61 Richards St., Brooklyn, N. Y.
Windau Tool Co., Cleveland, O.

**Tool Salvage**
Glenzer Co., J. C., Detroit, Mich.

**Tool Salvaging Machines**
Machinery Co. of America, Big Rapids, Mich.

**Torches, Oxy-Acetylene and Oxy-Hydrogen**
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**Tracing Cloth and Paper**
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Universal Drafting Machine Co., Cleveland, O.

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See Cabinets, Filing.

**Tracks, Trolley and Overhead**
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Northern Engineering Works, Detroit, Mich.
Yale & Towne Mfg. Co., 9 E. 40th St., New York.

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Reliance Elec. & Eng. Co., 1056 Ivanhoe Road, Cleveland, O.
Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh,

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**Transmission Machinery**
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Wright Mfg. Co., Lisbon, O.
Yale & Towne Mfg. Co., 9 E. 40th St., New York.

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New Britain Mch. Co., New Britain, Conn.

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**Tubing, Flexible**
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Breeze Mfg. Co., Newark, N. J.

**Tubing, Seamless Steel**
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Frasse & Co., Inc., Peter A., 417 Canal St., N. Y.
Maxim Silencer Co., Hartford, Conn.
National Tube Co., Pittsburgh, Pa.
Standard Parts Co., Cleveland, O.
Ward's Sons, Co., Edgar T., Boston, Mass.

**Tubing, Steel**
Blum & Co., Julius, 510 W. 24th St., New York.
Frasse & Co., Inc., Peter A., 417 Canal St., N. Y.
National Tube Co., Pittsburgh, Pa.

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Meiselbach, Catucci Mfg. Co., 27 Congress St., Newark, N. J.
Newman Mfg. Co., Cincinnati, O.
Phoenix Mfg. Co., Eau Claire, Wis.

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Pratt & Whitney Co., Hartford, Conn.

**Twist Drills**
See Drills, Twist.

**Unions**
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New Britain Mch. Co., New Britain, Conn.
Prentiss Vise Co., 106 Lafayette St., New York.
Reed Mfg. Co., Erie, Pa.
Western Tool & Mfg. Co., Springfield, O.
Yost Mfg. Co., Meadville, Pa.

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Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill.
Brown Engineering Co., 133 N. 3rd St., Reading, Pa.
Carter & Hakes Co., Sterling Place, Winsted, Conn.
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Cochrane-Bly Co., Rochester, N. Y.
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Bignall & Keeler Mch. Works, Edwardsville, Il.
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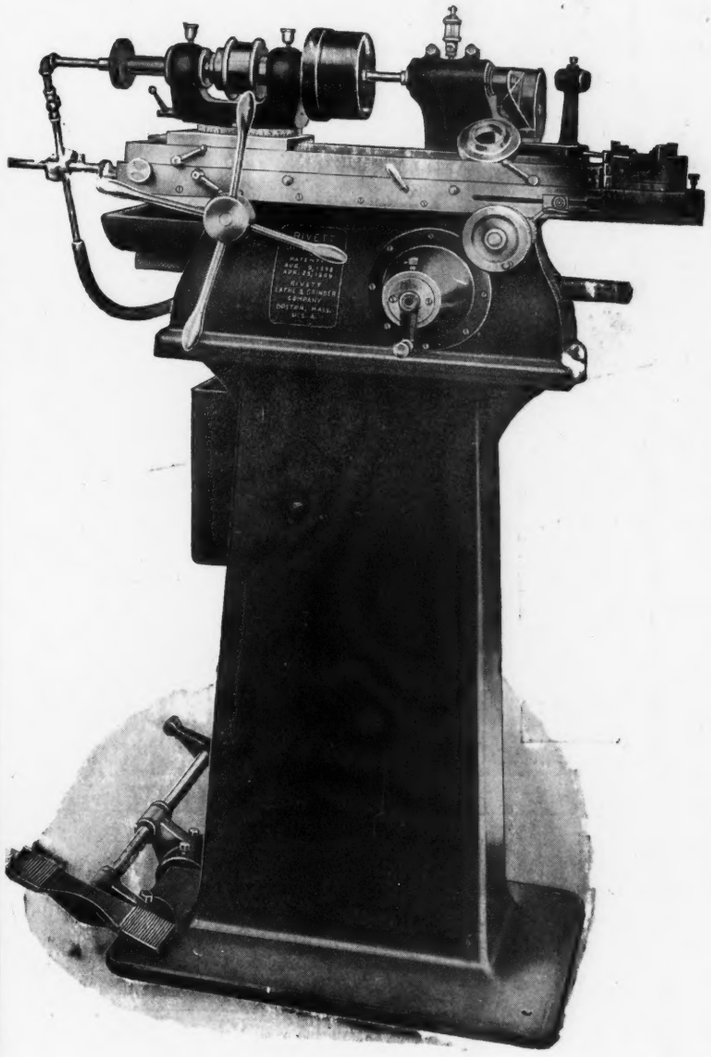

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Full automatic in operation; embodies the Rivett Taper Cam as means for automatic longitudinal table travel.

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**Brighton, District of Boston**

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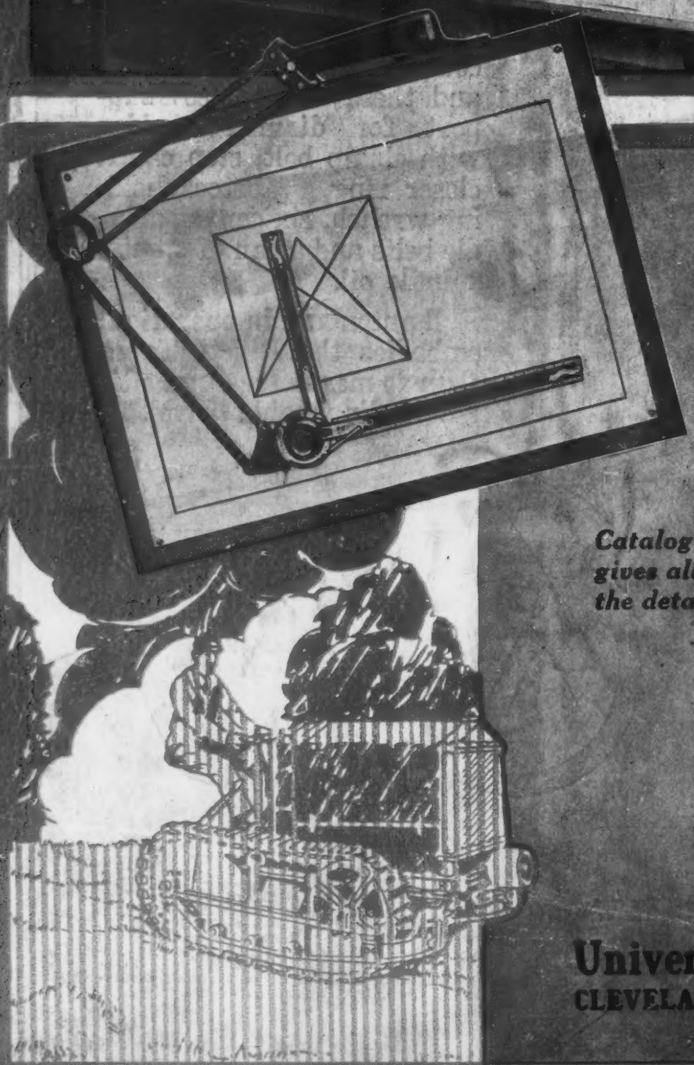
# Universal Drafting Machine



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